4th QUARTER 1971

BIOENVIRONMENTAL SAFETY NEWSLETTER

NAVAL SAFETY CENTER, CAPT W.E. SIMMONS, COMMNDER

Prepared by Life Sciences Department *U. S. Naval Safety Center, Naval Air Station, Norfolk, Va., 23511*

What It's All About

What's the Navy's accident investigation and prevention program all about?

From time to time, an investigator or an endorser to an accident investigation report sums it up for us so well that we like to quote and pass the word along. The following comes from an endorsement by the Commanding General, Fleet Marine Force, Pacific on an aircraft accident investigation report. In principle, it applies equally well to the investigation of any kind of Navy or Marine Corps accident.

"The aviation safety program took its first step up when cognizant officials became convinced that 'Accidents don't just happen, they are caused.' The purpose of a mishap investigation is not to categorically charge with blame one person, procedure or item of material. Its purpose is to delve deeply into all events and details of the mishap. As such, the (Accident Investigation) Board's influence may extend across many departments, commands and agencies in an effort to clearly depict the cause or causes and associated contributing factors. Education is the most effective tool in accident prevention. Therefore, the Board's documented results of an investigation are published and purposely submitted through the chain of command in order that the cognizant agencies may take appropriate measures to prevent the recurrence of a like mishap..."

Right on!

-CAPT Earl Ninow, MC, USN
Head, Life Sciences Department

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RF Health Hazards and Monitoring Meters--Recent Notes

Over the past several years there has been a great deal of deliberation, both nationally and in the military, regarding the hazards of RF (radio frequency) radiations. Much controversy surrounds the following questions:

(1) What levels of particular frequencies are actually harmful to health, both in the acute and long-range (chronic) exposure situations?

(2) What do medical surveillance and injury statistics show?

(3) What is the worth of existing monitoring devices.

Uncertainties in these related areas have caused the Navy (BUMED) to undertake new research and studies. Others are making similar efforts. The following is a brief overview of this subject and includes impressions received from discussions at recent national meetings (International Conference on Non-Ionizing Radiation Safety, March, 1971, and Aerospace Medical Association Meeting, April, 1971).

What levels and what frequencies are harmful?

NAVORD OP-3565/NAVAIR 16-1-529 and NAVSHIPS 0900-005-8000, technical manuals on RF hazards, describe possible hazards to health of electromagnetic radiation. The frequency range referred to is not specified but presumably applies to radar frequency emissions (microwaves) in the range of about 300 MHz (megahertz or megacycles per second) to several thousand MHz. American National Standards Institute (ANSI) Standard 95.1, Safety Level of Electromagnetic Radiation with Respect to Personnel, covers the frequency range of 10MHz to 100,000 MHz. Each of these documents has recommendations to prevent exposure to radiation beyond a tentative "safe limit" of 10mw/cm^2 (power density level). In ANSI 95.1, this limit is referred to as a "radiation protection guide," a limit not to be exceeded "without careful consideration of the reasons for doing so." This permissible level of 10mw/cm^2 is based on recommendations made many years ago on the "best of available data" at that time. It was deduced by applying "a safety factor" to the level thought to induce opacities in the lens of the eye (cataracts). Present and continuing U.S. research will explore the validity of the 10mw/cm^2 standard and also seek to answer questions related to extraocular effects. East European data have existed for years which claim adverse bio-effects at levels much less than 10mw/cm^2. U.S. experts, however, are reluctant to rely on such data or to duplicate the research for various reasons.

The above mentioned ANSI Standard 95.1 is being revised. The appropriate "guide number" or "safe-limit" to use and proper connotation to be ascribed to the "number" is being studied by ANSI. At the present time, there appears to be no concensus among U.S. experts which indicates that eye injury will occur at or a little above the 10mw/cm^2 level. Neither is there a concensus which says there can be no chronic injury below the 10mw/cm^2 level. Little is said on the level producing other-than-ocular effects since there has been little study on this in the U.S. The Public Health Service (Bureau of Radiological Health) in its recommendations on radiation limits from electromagnetic devices (microwave ovens, etc.) has cautiously relied on manufacturers' capabilities in reducing permissible levels to the more conservative 1 mw/cm^2 level. Chronic injury is not ascribed to this lower level, which is viewed as a "radiation protection guide" level rather than an "unsafe" level.

As regards the influence of frequency on RF radiation bio-effects, there is most likely variation in effects but little has been documented on this. In the

frequency range below 300 MHz, the effects from low energy levels become more relatable, according to East European data, to effects on the central nervous system and manifested in various psychophysiological or behavioral responses. In those countries, there are "sanitary rules" intended to limit exposure to radiations from these lower frequencies. Exposure limits are in terms of maximum volts per meter (V/M) or amps per meter (A/M). The literature on effects from extremely low frequency (ELF) radiations, e.g., 10 to 100 Hz (cycles per second) is scarce. This relates directly to the Navy's SANGUINE project, an effort to build huge underground radio antennas which would send low frequency signals around the world for communication purposes. Significant harmful bio-effects from this radiation, at exposure levels contemplated, are not known to occur but research is being conducted at NAMI (Naval Aerospace Medical Institute) to probe this area.

A reasonable summary of the foregoing is the following: Due to uncertainties in existing biological data, the 10mw/cm^2 "permissible" exposure level should not be regarded as a dividing line between safe and unsafe levels. Slight excursions above this level should not cause undue alarm. On the other hand, levels of exposure should be kept as far below the 10mw/cm^2 level as is prudently possible. In using "Safe Distances to Personnel" charts, as in NAVORD OP-3565/NAVAIR 16-1529 and various MIM/NATOPS aircraft manuals, do not crowd these "safe" distances and stay completely outside the radiation field where possible.

Medical surveillance and injury statistics

A medical surveillance requirement exists for personnel whose occupations potentially expose them to significant levels of microwave radiation. The Bureau of Radiological Health (Public Health Service) conducts a Radiation Incidents Registry (maintained under authority of the Radiation Control for Health and Safety Act of 1968). The Registry functions as an information center. However, in Registry Notes of October 1970, no serious injuries due to RF emissions are reported to that date; injuries reported were due to lasers, UV-lamps and x-rays.

One non-military opthalmic expert is making a separate and continuing study of the eyes of a large number of occupationally exposed radar workers. In those who have had exposures above the "permissible" level, a small but significant percentage (less than 1%) are being followed up periodically for eye abnormality (opacities of the lens). Other experts who contest these findings allege that control data is missing, exposure documentation is not reliable or that the opacities seen are not specific to microwave injuries. What is showing here is that, in spite of limited medical surveillance, statistics which document the extent of injuries and quantify injury against exposure levels appear to be non-existent.

To date the Naval Safety Center has not received an injury report in which an injury and related exposure level were substantiated and correlated. Note that this does not apply to RF burns, another phenomena related to contact electric shock received from voltages induced in metal structures in an RF field. There have been several recent reports of RF burns. The lack of radiation injury data cannot be taken as an indication that there have been no injuries, however, since injury reporting systems may not be amenable to collecting this type of data. The Navy reporting system, for example, has certain limitations whereby potential injuries from this cause would not necessarily be reported to the Safety Center for the data bank.

Problem of existing monitoring devices

The previously referenced NAVAIR/NAVORD Manual refers to obtaining assistance regarding RF radiation hazards from NAVSEC 6179C. This office (6179C) has expertise in performing RADHAZ surveys and in use and calibration of monitoring equipment. Industrial hygienists and others are also performing monitoring services. A previous BESNL article referred to precautions and monitoring related to the increasing use of microwave ovens which potentially can leak excessive amounts of radiation (BESNL 3-70, p. 21-22). In all this work there is a need for reliable portable monitoring instrumentation. This requires, in turn, reliable instrument calibration techniques which should be readily available. This appears to be a weak spot in the documentation of exposure levels, as manufacturers and others use various calibration methods and confusion exists as to which are reliable and practical. In this regard, our compliments are extended to Mr. Fred Hertlein, Head, Industrial Hygiene Branch, Pearl Harbor Naval Shipyard, for his persistent efforts in renewing the interest of various national agencies and naval activities in getting action to standardize calibration procedures for RF power density meters. Mr. Hertlein has consulted with agencies such as National Bureau of Standards, Scientific Apparatus Makers Association, American National Standards Institute (ANSI), Institute of Electrical and Electronic Engineers, NAVORDSYSCOM and American Conference of Governmental Industrial Hygienists. His efforts have resulted, among other things, in an appeal by the American National Standards Institute in ANSI Reporter, (29 Jan 1971 issue) to all organizations for information leading to early development of a standard calibration procedure for RF hazard (power density) meters.

Another extremely useful monitoring device, which appears to be non-existent, is a personnel monitoring device of the personal dosimeter type whereby the environmental level could be routinely documented and the energy dose to the individual recorded. This type of device exists for ionizing radiation personnel monitoring in the form of pencil dosimeters and film badges (normally worn on the chest). A "cigarette pack" type of RF dosimeter was experimented with several years ago by Douglas Aircraft Corporation. It fitted conveniently into the shirt pocket and was intended to buzz (audible signal) and light up (miniature neon-lamp) at or near the 10mw/cm^2 "hazard level." Even this limited capability would have been very useful but the device did not perform reliably. Very recently, a PHS Bureau of Radiological Health engineer indicated in personal conversation that development of a reliable personal dosimeter is feasible and that one is being designed. Conversations at the recent meetings referred to in the first paragraph above indicate a renewed interest in the need for such a device by specialists involved in RF hazard evaluation.

-John T. Maccioli
Naval Safety Center

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Safety Program Requires Complete, Accurate Data

Injuries are still occurring which meet the intent of reporting requirements in OPNAV Instruction 5100.11, Accidental Injury/Death Reporting Procedures, but which are not being reported to the Naval Safety Center. These include injuries from physical agents, such as heat, cold, noise and dust, and chemical agents. In addition, information on some reports received is insufficient for adequate analysis. The Navy needs accurate, complete data on accidents and accidental injuries in order to derive maximum benefit from its safety program.

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Touching All Bases--How to Investigate an Accident

A baseball player can hit a ball out of sight for what should be a home run but if he fails to touch any base when making his rounds to homeplate he might just as well have struck out. The end result is the same. In either situation, the umpire will yell the familiar, "Ye're out!" Similarly, anyone assigned the responsibility of investigating an accident must also "touch all the bases" or he might as well not have "come up to bat." The purpose of this article is to provide some basic guidance for personnel investigating accidents to ensure that they do, indeed, "touch all the bases."

1. Get to the scene of the accident as soon as possible after it occurs. Immediate on-the-scene investigation always provides the most accurate and useful information. A delay of even a few hours may permit important evidence to be destroyed or removed, intentionally or not. Only in this manner will you be able to best determine accident causes from firsthand information and observation, to actually see all the circumstances which might otherwise be altered or which should be considered and to expose yourself to the actual conditions surrounding the accident. Early arrival on the scene also enables you to conduct your investigation before those most directly involved have constructed defense mechanisms. Do not permit conditions at the scene to be altered in any way (unless further injury or destruction is imminent) until the area is completely surveyed and photographed, essential measurements are taken and you have adequate knowledge of the circumstances surrounding the accident. Do not permit bystanders and "souvenir hunters" to remove anything -- such items may be of value in the conduct of your investigation. Many difficulties can be avoided by having the area secured at the earliest possible time. Immediate response following mishaps also evidences to personnel the command's sincere interest in the accident prevention program. Be sure to contact the injured for his explanation of what happened as soon as possible but be sure that he is well enough and rational enough to be questioned. In serious injury cases, this should always be cleared through attending medical authorities. Do nothing to aggravate the condition of the accident victim.

2. Be prepared to answer these vital questions to your own satisfaction:
   - WHO was injured?
   - WHAT were the materials, machines, equipment and conditions involved?
   - WHERE did it happen?
   - WHEN did it happen?
   - HOW did it happen?
   - WHY did it happen?

As an investigator, you must be extremely observant ("information hungry") without being overly presumptuous. Be "nosey" without being overbearing. Never overstep the bounds of propriety. In short, be tactful! Explore the conditions that existed just prior to the accident as well as during and immediately following its occurrence.

3. Make no leading statements. Any suspicions, which are easily aroused at this time, that bias is involved, that anyone's interest is being prejudiced, that personal opinion is interjected or "snap judgment" is being made will immediately interfere with the investigation. Take no sides and make no sympathetic statements. Suppress the urge to ask leading questions. Inferences can be misunderstood since hasty assumptions are anticipated at such a time. Only arguments, lack of cooperation, disinterest and even attempts at collusion can result. "Mum"

is the word!

4. Be a good listener. So-called "facts" passed on by a bystander, an otherwise untrained person called in or someone who just happens to be on the scene, even if acting in an official capacity, can be taken only at face value. Many times these persons fail to perceive and/or report obvious conditions which clearly contributed to the accident. But listen well and interestedly to any and all information volunteered, regardless of how unlikely or irrelevant it may appear at the moment. Be fair, considerate, patient and calm. Never raise your voice. Control your voice inflection when you speak. Evaluate mentally -- not orally. Keep any assumptions you may have to yourself.

5. Take written, signed statements from all individuals involved and from witnesses. While two people seldom see or report exactly the same thing when witnessing the same action, it is important that all statements be taken despite reported conflicts. Never take a witness statement in the presence of or "within earshot" of another witness. You may be putting the words of one witness into the mouth of another. Remember, just one variation in a witness account might turn out to be a true lead or indicate a valuable and completely different course of action to pursue. Don't interrupt or correct a witness. It's his statement. Don't proofread, correct word usage or change what he has to say or how he says it. To do so after he has penned his name opens the statement to challenge and renders it worthless. Once a statement is signed and witnessed, it can become a legal instrument. Let your witness end a sentence with a preposition or a dangling participle. This isn't an English lesson. You can help the witness, however, without leading him, by advising beforehand what kind of information you seek and the limits within which he is to hold: only what he actually knows or actually saw. If he wants to write his own statement, so much the better but don't fall for the "I'll bring it to you later" bit. You want and need it now and without delay. Memory fades fast. Otherwise, you cannot know that it is his statement, that he prepared it and that it hasn't been altered or corrected or influenced by another party. One method is to put the individual at ease and have a stenotypist or stenographer take down his statement verbatim while he discusses the event. This is read back to him, corrections are made and it is then typed for his signature. This is an excellent method to employ when a large number of witness statements are desired. While a tape recorder can be conveniently utilized to record a statement, it must be transcribed onto paper and signed. Witnesses should not be permitted to discuss the accident among themselves. Those awaiting turns to provide their versions of what happened should be kept occupied and segregated as much as possible during this time interval to minimize the risk of losing what could be valuable information for the investigator.

Always be sure to obtain the complete address and telephone number of each witness in case you need to make contact later. As mentioned earlier, when interrogating a witness, ask questions in such a manner that you do not lead him into an answer he thinks you might want rather than what actually happened. Ask questions in such a manner that he has to tell you what he actually saw. For example, rather than ask him, "How much was the vehicle exceeding the speed limit?" inquire, "How fast was the vehicle traveling?" Otherwise, you could wind up answering yourself.

6. Compare all the facts you've collected. Don't work to make your assumptions

fit the facts. Your assumptions will prove or disprove themselves during the course of your investigation. Are you satisfied that you now have enough information to enable you to responsibly reconstruct the incident? Do you have the correct version of how and why it happened? Is it logical? Does it follow? Have you separated facts from fiction? Does it meet the test? Have you played the role of "the devil's advocate" in an attempt to meet every conceivable challenge? Could the incident have happened in any other way? If not, why not? Have you weeded out all unverified or circumstantial "evidence," assumptions and fantasy? Have all essential chemical and physical tests and analyses been made to determine material stress or strength, mechanical failure, poor or improper design, presence or concentration of any toxic gas, corrosive chemical or other foreign substance? Have you consulted appropriate medical, legal, engineering and other authorities and considered this information in your investigation? Results from autopsies and metallurgical studies are just two excellent sources of basic information. Have you reviewed similar mishaps reported by counterparts? Studied scheduled maintenance reports? Have you contacted the supplier or the manufacturer relative to performance requirements, quality standards and prior accident experience? Have nationally recognized standards been violated? Have all witness statements been carefully reviewed? What is "hanging fire"? Run down every item that just doesn't "smell" quite right. You've got to collect every piece of this jigsaw puzzle or you'll never put it together to satisfy yourself, much less anyone else. Check and re-check any measurements or photographs taken at the accident site. (A camera is essential to provide instant photographs to capture on film what you want and need. If the photograph doesn't reveal what you intend to show, an almost immediate retake will provide this information.)

A good accident investigator has to use keen imagination to reconstruct events and has to exercise good analytical judgment. His investigation cannot be clouded by preconceived theories. No one can be shielded. Only the truth is sought. It must be kept in mind that it is not the purpose or intent of accident investigations to "fix blame" but to uncover facts. The search for a "fall guy" will hamper the investigation and make a difficult job even more difficult.

One cannot obtain too much information about an accident. What may appear to have been a simple, uninvolved accident may have contributing factors which become more complex or vague as leads are followed. Underlying causes must be sought out. The investigator must use common sense, imagine himself in the place of the accident victim and contemplate his every move under the circumstances which existed at the time of the incident. Regardless of how much he is tempted to stray, the investigator must rely only on factual information, weighing value and involvement to reach only justified conclusions. An apparently reasonable conclusion may have to be altered in light of the discovery of additional information. A person who makes a mistake and does nothing about it has already made his second mistake. This is why we investigate accidents. Accident analysis cannot be better than the facts on which it is based. So above all else -- GET THE FACTS!

A word of caution is in order. The press is always on the job. Serious accidents make headlines. Failure to provide essential information surrounding a mishap invites assumptions to complete news accounts. At times, contradictory, embarrassing and untrue news stories result. In all cases where public interest is likely to be stirred, and certainly in all cases involving serious injury and/or extensive property damage, and in order to avoid "bits and pieces" of contradictory information from being drawn from varied and even unknowledgeable sources, it is always best to establish a central point from which public information can be

released. The PAO or other professional or responsible individual can provide timely information to the press but only information which has been confirmed without prejudice.

All of the foregoing may appear to be a lot of "legwork"... and it is! The amount of perspiration is influenced by the amount of inspiration to perform a creditable job. The sequence is important. Not only must you "touch all the bases" but you must perform in an orderly manner. (Note: The "ump" will call you "out" if you run from third to first base.) While a good accident investigator performs these functions almost automatically, no two accident cases are alike nor should they be so treated. Even the experienced investigator becomes a "cropper" on occasions. It only takes one little thing he overlooks to turn a beautiful case into a shameful "bust." If you know you're right, "stick by your guns" until convinced otherwise but have an open mind. Stubbornness will only lead into blind traps and a poor rapport with others. This doesn't mean being gullible. You've got to be a "take-charge guy" and act and move in a confident manner which suggests that you've got a job to do and that you're competent and know how to do it.

In summary, get to the scene as soon as possible; explore the history of the incident to determine what took place immediately before, during, and immediately following its occurrence; secure witness statements from as many "reliable" sources as possible; examine the physical environment associated with the accident as thoroughly as your experience and conditions permit; and develop this information to determine causal factors to prevent a recurrence.

It has been said that the only thing of value which can be salvaged from any accident is the knowledge gained to prevent it from happening again. It is important, then, that a proper investigation of the circumstances surrounding it be made. Those who cannot remember the past are condemned to repeat it. It is up to you to touch all the bases!

-Alvin N. Blum
Naval Safety Center

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Physical Qualifications- the First Step in Personal Safety

The Chief, Bureau of Medicine and Surgery prescribes the physical standards for naval service. These established standards aid in the procurement and retention of personnel who are physically fit and temperamentally adaptable to the conditions of Navy life.

Every person is in a sense handicapped for some particular job and the best approach is to assign a man according to his physical and psychological capacities. However, if the stresses of a job are exceptional or unknown, the initial physical examination loses much of its value because a man may be assigned to a job which exceeds his physical capacities. To avoid this problem, certain groups of Navy personnel, by reason of the particular type of duty to which they will be assigned, are required to meet physical standards which differ somewhat from those in the routine examination for enlistment or appointment. For example, applicants for aviator training receive a special examination to ensure that only those applicants who are physically and mentally qualified for such duty are accepted and to screen out from such duty those wno may become temporarily or permanently unfit because of physical or mental defects. The main objective in examining candidates for flight

training is selection of individuals who can fly safely and continue to do so for at least 20 years.

Other special categories are submarine personnel, diving personnel and personnel assigned to the nuclear field and Antarctica. Personnel being assigned to State Department duty and those being detached to sea duty or duty outside the 48 contiguous United States require a special physical examination. Special physical examinations are required for personnel before they can obtain an Explosive Driver's License. A special examination is required for personnel assigned to food-handling duties. All persons prior to being assigned to duties involving exposure to ionizing radiation and potential internal hazards must be examined to determine their suitability.

Annual physical examinations are required for certain categories of naval personnel though they have no known defects or handicaps. All naval officers, enlisted men over the age of 40, enlisted men in flight status, divers, midshipmen and students in the Navy Enlisted Scientific Education Program must have annual physical examinations. A complete physical examination must be conducted semi-annually on officer and enlisted firefighting instructors whose duties expose them to toxic fumes or inhalation of smoke or there is a possibility of such exposure.

Naturally, non-periodic examinations are completed to evaluate fitness after exposure to radiation, toxic chemicals, serious illness, injury or surgery. These examinations include but are not limited to medical history, audiograms, urinalysis, complete blood count, serological test for syphillis, electrocardiogram, chest X-ray and dental examination. Other tests and procedures may be conducted and follow-up examinations performed if history or routine examination reveals any evidence or symptoms of disease.

Since the primary function of the Navy Medical Department is to keep men on the job insofar as consistent with their ability to perform and the individual's own welfare, it is a continuing responsibility for all medical departments to ensure that Navy personnel are physically qualified to safely perform their regular established duties. Strict adherence to established physical standards is the first step in personnel safety.

-HMCS N.D. Walker, USN
Naval Safety Center

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Safety Items Concerning Commercial Products - Excerpts From Message Traffic

Swordfish: The Food and Drug Administration has advised that consumption of swordfish should be discontinued because of unacceptable levels of mercury contamination. (CMC message 290027Z of May 1971.)

Play Shaving Kit: The Food and Drug Administration has warned that components of a nationally distributed child's novelty shaving kit are contaminated with a dangerous bacteria and present a severe health hazard to children. The product is labeled "Merry Lather 'N Lotion Toy Toiletries." The manufacturer is voluntarily recalling the item from the retail level. No deaths or injuries attributed to the product have been reported. (NAVRESO Brooklyn message 2821027 of May 1971.)

Botulism in Vichyssoise: The Food and Drug Administration has issued an urgent warning that Bon Vivant Vichyssoise Soup in 13 oz. and 50 oz. cans with code number V-141/USA 71 on the top has botulism type A contamination. All commissary stores have been directed to withdraw these items from sale. (NAVRESO Brooklyn message 022109Z of July 1971.)

The FDA subsequently extended this recall to cover all soups, sauces and other canned foods processed by the Bon Vivant Soups. All Navy activities have been directed to remove from sale or consumption any product with the Bon Vivant label. No Bon Vivant items have been identified as standard stock and thus would not normally be found in General Messes. However, private messes, clubs, commissary stores and Navy Exchanges may have procured these products. (CNO message 092229Z of July 1971.) A subsequent CNO message (241336Z/129 of July 1971) lists products sold under other brand names which were processed by Bon Vivant Soups, Inc. which are being recalled by the FDA as potentially hazardous. Again, none of the listed items has been identified as standard stock and would not normally be found in general messes; however, private messes, clubs, commissary stores and Navy Exchanges may have procured these products.

Armour Genoa Salami: The Dept. of Agriculture has stated that Armour & Co. is voluntarily recalling all Armour Genoa Salami because of finding staphylococcus toxins in some samples. This item is being removed from sale or consumption in all Navy activities. Although not normally carried in the supply system for general mess use, activities may have procured this product locally as a speciality item. (CNO message 232124Z/128 of July 1971.)

Hormel Genoa Salami: The Dept. of Agriculture has announced that Hormel & Co. is voluntarily recalling all Hormel Dilusso Genoa Salami packaged in 4 ounce "Flex-Vav" packages because staphylococcus toxins have been found in some samples. This item is being removed from sale or consumption by all Navy activities. Although not normally carried in the Navy supply system for general mess use, activities may have procured this product locally as a speciality item. (CNO message 310142Z/133 of July 1971.)

Jequirity Bean Jewelry: Customs agents inspecting the possessions of personnel aboard ships returning from Caribbean and African waters have reported discovery of jewelry, usually multiple strand necklaces and bracelets, made from jequirity beans. These beans contain a toxic substance causing nausea, severe diarrhea with colic, weakness, accelerated pulse and tremors when chewed or swallowed and can result in death. The small hard, smooth beans are spherical in shape and scarlet in color with a black spot. U.S. customs officials have been directed to confiscate all items containing the jequirity bean. (CINCLANTFLT message 281050Z of May 1971.)

Defective Rattles: Plastic Assorted Baby Rattles made in Hong Kong (source: Sanitoy, Inc., New York, N.Y.) which have been examined have burrs and defective seams exposing sharp cutting edges. Navy exchanges have been directed to withdraw the product from sale. (NAVRESO Brooklyn message 252110Z of June 1971.)

Cadmium in Love Bead Candy: The Ce De Candy Co. has recalled Candy Love Beads and Luv Beads, style 620R because the item contains a high level of cadmium and presents a moderate to severe health hazard to children. NAVRESO has directed that the product be removed from sale. (NAVRESO Brooklyn message 242102Z of May 1971.)

Black and Decker Arm Saw: The Black and Decker Power Tool Manufacturing Co. has advised its customers, including Navy Exchanges, of a potential safety hazard in the operation of Model 7700 Compact Radial Arm Saw. The company advises that there are operating conditions which could cause the sawhead to separate from the radial arm of the No. 7700 saw and present a potential safety hazard. The company engineering group has developed safety features to be incorporated in future production; meanwhile, the company is calling in No. 7700 saws for updating. Use of the saw should be discontinued and the arm and motor assembly of the saw should be returned to the nearest Black and Decker Service Center, either in person or transportation charges collect. The name and full address of the owner should be enclosed. The machine will be processed and returned at no cost. (Correspondence from E.R. Gerety, Black and Decker Mfg. Co., 21 May 1971.)

Electric Percolator: NAVRESO, Brooklyn advises that 10-cup electric percolators Model M-0181-35 (gold color) and Model M-0181-37 (avocado color) manufactured by the Mirro Aluminum Co. are potentially hazardous and are being withdrawn from sale at Navy Exchanges. (NAVRESO BKLYN message 272100Z of July 1971 refers; message 252111Z of June 1971 advised of a problem with Model M-1179, a 5-9 cup electric percolator.) Navy Exchanges are returning these products in stock to the manufacturer for replacement with corrected models.

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Don't Be Caught Dead Sitting on Your Seat Belt

In 1970, for the first time in many years, there was a sizable drop in the number of accidental automobile deaths -- 1,100 fewer deaths than in 1969. According to the National Safety Council, this improvement was due to several things. Among them: safer highways, safer automobiles, more driver training, a growing emphasis on better control of the drinking driver, and increased use of safety belts.

For a number of years, the Council has been saying that if all automobile passengers used safety belts all the time, 8,000 to 10,000 lives could be saved each year. The statistics indicate that a start has been made toward this goal. But there is still a long way to go. In your contacts with employees, point out the value of safety belts and shoulder straps in preventing death and minimizing injuries:

. The National Highway Safety Bureau, U.S. Department of Transportation, reported that not one person wearing both a lap belt and shoulder harness has been killed in an auto accident at speeds up to 60 miles an hour. The Bureau also stated that not one driver wearing a seat belt alone has been killed in a car equipped with a collapsible steering assembly in an accident below 50 miles per hour.

. The Ohio State Highway Patrol reports that of the first 190 people killed on Ohio highways in 1971, 186 were not wearing safety belts.

. An 18-month Colorado study of 834 crashes in which 976 persons were fatally injured shows that only 6.5% of the 2,523 people involved were using safety belts. Slightly more than 70% of the belted persons survived the crashes. Of the occupants thrown out of vehicles, 69.5% were killed.

-Bethlehem Steel Safety Bulletin

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NHTSA Advisory on Sports Car/Motorcycle Helmets

The National Highway Traffic Safety Administration recently issued a public advisory warning that it has received an increasing number of reports concerning safety helmets, designed and sold for the use of sports car enthusiasts and motorcyclists, but proving to be of little protection to the user. NHTSA says it has received reports of certain helmets, so fragile as to shatter on the slightest impact.

NHTSA is conducting a testing program to identify these unsatisfactory makes. The hazard is particularly great for users who purchase a safety helmet which performs well at the time of purchase, NHTSA said, but which may unpredictably develop serious faults, becoming a hazard in itself and giving no protection in the event of a highway crash. The advisory recommends precautionary steps which helmet users and new purchasers should exercise:

(a) A helmet user should know of what material his helmet is made. Currently helmets are almost exclusively manufactured from fiberglas or polycarbonate materials. Fiberglass helmets most often are painted on the outside while polycarbonate helmet material is either transparent or has the color impregnated into the material. Those made of transparent material are usually merchandised with an inside paint or coating. Polycarbonate helmets should not be painted or decorated by the user except with paints that can be certified by the manufacturer as compatible with the helmet material. If the user cannot otherwise identify this material when used in a particular helmet, the information should be available from a retailer who deals in safety helmets.

(b) Solvents and cleaning materials, unless certified by the helmet manufacturer as compatible, should not be used on any helmet type. Destructive chemical reaction is caused by a number of such cleaning agents and in particular can occur with the polycarbonate types.

(c) Residents of states which publish a listing of approved helmets should purchase only those which are on the approved listing. This pertains to safety helmets of all makes. Lacking such listings, purchasers will obtain an extra measure of safety by purchasing those helmets which carry a label-certification that the product has met the Z90.1-1966 Standard. This is a self-imposed standard set by the industry's American National Standards Institute.

(d) If cracks or stress lines appear on the helmet, replace it immediately.

The NHTSA advisory also states that detailed information on defective helmets is being sought from the manufacturers while, additionally, a Federal standard is being readied which will extend to all protective headgear. Until the effective date of the standard, the public is urgently advised to observe the precautions listed.

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Keep the "Merry" in "Merry Christmas"

It's not too early to think about Christmas and the steps you can take to prevent a holiday fire tragedy. This timely reminder comes from the National Fire Protection Association (NFPA) which urges everyone to keep fire safety in mind when planning Christmas trees, lighting, decorations, wrappings and gifts. Each year, NFPA points out, lives are lost in fires directly related to the Christmas season. Also, last year in the United States alone, holiday fires damaged or destroyed homes and other property valued at about $3,176,000.

Here are some suggestions from NFPA for keeping the "merry" in "Merry Christmas":

Tree -- Select a firm, fresh one and put it at once in a cool place with its base in water. Before setting it up, cut about an inch off the base to help the tree absorb water, then place the tree in a sturdy stand containing water. Be sure the water level stays above the cut -- check it daily. Locate the tree away from heat and where it won't block exits. Take it down as soon as possible after Christmas -- the more it dries out, the more of a hazard it becomes. Don't rely on do-it-yourself flameproofing treatments.

Lighting -- Never use lighted candles on a tree or near any evergreen decorations. Check sets of electric lights closely for worn insulation, broken plugs or loose bulb sockets and use only sets with Underwriters' Laboratories (UL) or Canadian Standards Association (CSA) label. Use extension cords sparingly. Never hang sets of lights on a metallic artificial tree. To avoid shock hazard, use only indirect spotlighting on such a tree. A metallic artificial tree should carry the UL label if it has a built-in electrical system. Turn off all indoor tree and decorative lights when you leave the house or retire for the night. Outdoor lights should have special wiring.

Decorations -- Use materials which are non-combustible such as glass and asbestos or which are flame-retardant. Keep natural evergreens and polystyrene foam decorations away from candles, fireplaces or other open flames. Be sure holiday costumes and masks, such as Santa suits and whiskers and children's pageant outfits, are flameproofed.

Wrappings -- Pick them up while opening gifts and put them in covered trash containers. Never burn wrappings, cartons, etc., in the fireplace.

Gifts -- To meet safety standards, electric toys should carry the UL or CSA label.

Some other general holiday reminders from NFPA include these: Keep children from playing under or near the Christmas tree to avoid the danger of it falling over; be especially careful with matches and smoking materials; and review the family's home escape plan for quick exit in case of a fire emergency. Also, even with the pressure of last-minute shopping and errands as Christmas nears, never leave children alone or without proper supervision.

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Toys and Play Equipment

This is the time of year Navy families begin to think about holiday toys. The following material on the subject comes from the National Safety Council.

As with many other types of accidents, complete statistical data on injuries caused by toys and play equipment are not available and would be difficult to obtain. Limited studies can, however, give us some insight into the problem, as do news clippings and hospital emergency reports. A survey by the Metropolitan Life Insurance Company reported that 4 per cent of 6,312 home accidents were attributed to toys and play equipment.

A three-month survey on playthings was sponsored by the Toy Safety Committee of the National Safety Council and was conducted with the cooperation of the Florida Pediatrics Society, the Florida chapter of the American Academy of Pediatrics and the Florida State Board of Health. Details on 748 accidents involving toys and other playthings were accumulated and analyzed.

Small, commercial toys were involved in only 7 per cent of the injuries reported. In contrast to this, more than one-fourth of all the accidents included household objects not usually regarded as toys by adults (broken glass, rusty cans, household tools, etc.). Bicycles and tricycles were the playthings most frequently reported as responsible for injuries, accounting for approximately 22 per cent of all accidents.

Three-year olds were more often involved in injuries from commercial toys, whereas bicycles and sports equipment caused injuries among older age groups. Playground equipment accounted for the most injuries to the two- through seven-year-olds. Age five appears to be the most vulnerable single year for both boys and girls. In general, boys were injured in such accidents almost twice as often as girls.

The Florida study also indicated that few of the accidents were fatal or were serious enough to require hospitalization. Fractures and multiple injuries were the most frequent causes of hospitalization and lacerations were by far the most numerous type of injury, occurring in nearly 40 per cent of the reports.

Certain toys may be hazardous in themselves such as a flammable doll, a toy with a sharp edge or equipment of faulty construction. In other toys such as an electric iron the hazard may be created by lack of maintenance. A wrong toy or any toy can also be unsafe when it is given to the wrong child, to a child at the wrong age or when it is misused.

A child's safety is dependent on the types of toys selected, the way they are maintained and by the amount of safety training received in the home -- all jobs normally done by parents or adults.

Interest by adults in toy safety programs should be high not only because of the concern for the well-being of their children, but also because of the variety of toys and playthings on the market today.

Federal Legislation. The Child Protection Act of 1966 amended the Federal

Hazardous Substances Labeling Act in several significant aspects. The word "Labeling" was deleted from the original Act, thereby providing additional protection for the consumer against products that do not carry a label. The new amendments also ban the sale of toys and other children's articles that are hazardous or which contain hazardous substances, regardless of their packaging.

The Child Protection Act now enables the Food and Drug Administration to take seizure action on such playthings as fireworks known as "cracker balls," flammable dolls, toy ducklings stuffed with contaminated substances and jequirity bean jewelry.

Some playthings and equipment are excluded in the 1966 Act. Certain children's articles, by reason of their functional purpose, require the presence of hazardous substances. For example, chemistry sets and certain art materials are exempted provided they carry appropriate warnings and are intended for children old enough to read and heed warnings. Warnings must appear on the packaging of any hazardous product, or, if such items are not sold in packaged forms, the warning must be placed on a sticker or tag securely fastened to the article or on the article itself.

U.S. Standards have largely eliminated the problem of poisonings caused by paint on toys and children's art supplies such as clay, crayons and finger paints. The designation "non-toxic" will usually be found on these types of articles. Some imported toys and supplies may not meet the same requirements as American-made products, so it is best to check before purchasing.

Lead poisoning will not likely be a problem with newly purchased toys; however, repainted, "hand-me-down" or antique toys may still constitute a hazard to children. Paint used on children's toys and furniture should not contain even small amounts of lead, antimony, arsenic, cadmium, mercury, selenium or soluble barium. Non-toxic paints are available for this purpose.

Home Chemistry. The chemicals found in the usual home chemistry set are comparatively harmless if the directions in the manual are followed and only the materials provided in the original set are used. Children must be old enough to understand the necessity for following directions in performing the experiments. No other chemicals or substances should be used and replacement chemicals or apparatus should be purchased from the manufacturer.

Devices and fuels for rocketry are very dangerous and the firing of rockets endangers not only the participants, but the general public as well. Experimentation with rockets and fuels by youngsters and amateurs should not be permitted.

Play Equipment. There is no single age at which a child is old enough for certain equipment, such as bicycles, skis, skates, tool kits, archery sets and air rifles. The development and experience of an individual determine his ability more than does his chronological age. A child should be mature enough to know the danger involved in a particular type of activity and to understand the safe use of such playthings. Guidance and instruction should be given before a child is allowed to use playthings with potential hazards. Certain rules should be set up for children learning to use bicycles and tricycles, skis, sleds, skates and other such equipment. None of these activities should be allowed where children are likely to interfere with automobile or pedestrian traffic.

Bow and arrow sets and darts must be used under supervision and only pointed at designated, safe targets. The National Society for the Prevention of Blindness reports that 17 per cent of the eye injuries to children are caused by bows and arrows, sling shots and B.B. guns. An air rifle or pellet gun should be handled as if it were any other gun. Parents must insure that children know the rules of gun safety and that these guns are used in a safely constructed and supervised target range.

Because falls are a frequent accident occurring from backyard swing sets, slides and teeters, children should be taught proper use of such equipment. Equipment should be the right size for the child. All such playthings should be assembled according to the directions of the manufacturer. Placement on level ground is desirable and away from fences, hedges or buildings that might force children to walk or play too close to the moving rides. Backyard equipment should be checked often for stability, excessive wear, loss of parts, and rust and should be repaired before further use.

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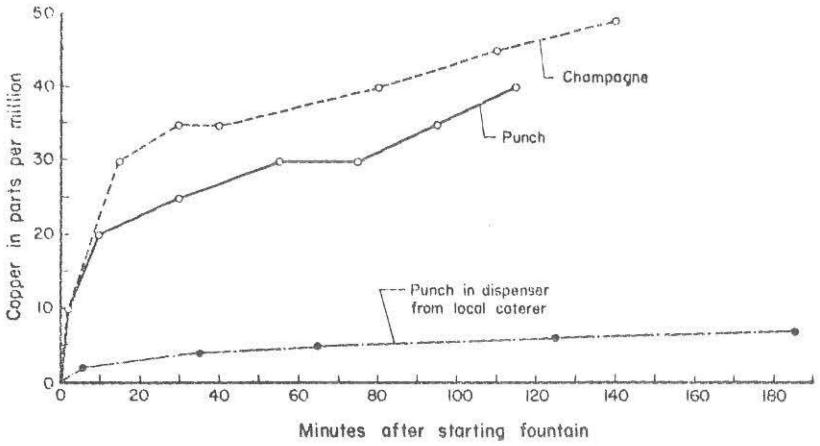
Party Safety: The Champagne/Punch Bowl

Drinking punch from a chrome-plated copper-base fountain beverage dispenser, under certain conditions, can literally be a sickening experience. A recent incident occurred in Michigan in which 18 out of 40 partygoers drank punch from such a dispenser and became very ill. The punch was made from syrup, soda, a carbonated "pop," ginger ale, vodka, lime/orange slices and ice. Symptoms were noted within 45 minutes after drinking the punch; some of the victims suffered from vomiting, diarrhea or cramps; some had all three symptoms. Analysis showed that the punch contained approximately 50 ppm (parts per million) of copper. The literature suggests that even lesser levels can induce symptoms of copper poisoning.

Extensive subsequent analysis performed with similar dispensers by the Michigan Department of Public Health showed that the amount of copper dissolved in punch is related to several variables. These include the amount of copper exposed from worn or eroded chrome-plated surfaces, the length of time the liquid is in contact with exposed copper and the type of liquid. Note in the above composition that the punch was an acidic liquid (acid) not so much from the weakly acid juices of the lemon and orange slices but from the acid gas CO_2 (carbon dioxide) -- the "fizz" in the ginger ale, carbonated "pop" and soda water.

The following chart depicts the test results on the offending dispenser showing in the two top curves the increasing dissolution of exposed copper surfaces with time. The bottom curve shows by comparison much less dissolution of copper from a similar dispenser where the chrome plate was not eroded to the same extent.



In view of this experience, the Michigan Department of Public Health (Sanitation Section) decreed that this type dispenser is not considered acceptable for use in public establishments because of the "environmental contamination" possibilities. Getting closer to home, the Manual of Naval Preventive Medicine (NAVMED P-5010), article 1-19, on the subject of hazardous metallic coatings states, "only approved cooking utensils and containers shall be used in food-service facilities." Although references are made in the article to "enameled (antimony), galvanized (zinc) or cadmium-plated utensils/containers," other metals which could precipitate poisoning episodes would be in the Navy "disapproved" category and would include such metals as lead and copper.

The above incident reminds this writer of several episodes of copper poisoning resulting from drinking fountain-type colas from vending machines. In these cases provisions did not exist to prevent the carbon dioxide in the machine from backing-up (leaking) into the copper feed water line causing toxic copper salts to form. These copper salts subsequently appeared in the drinks. There are specifications in Vending of Food and Beverages (Supplement 1, NAVMED P-5010-1) to prevent this. These include such positive protection provisions as use of double-check valves and air gaps and a requirement that military installations be furnished a "letter of compliance" by the installer. -J.M.

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If the Mask Fits - More on the Beard Question

The following item is reprinted from a recent Ships Safety Bulletin, a Naval Safety Center publication. It supplements "Safety Implications of Sideburns, Beards and Long Hair," BESNL 2-71. Please see also page 44, this issue.

"It is a fact that not everyone can wear an OBA or a MK5 gas mask and expect protection from a toxic or lethal atmosphere. The shape of a person's face can prevent the necessary mask seal that makes the equipment effective. For this reason, it is imperative that only those individuals who can obtain a satisfactory

skin-to-mask seal from an OBA or MK5 mask be assigned to appropriate billets in a damage control party.

"Additional complications can be expected when personnel who have beards and sideburns use these masks. Tests of bearded personnel using OBA's and MK5 gas masks were recently conducted at the Naval Schools Command, Treasure Island, California. The test involved exposing personnel to tear gas. It was not a quantitative determination of the amount of in-leakage into the respirator through the beard but a practical 'go or no go' type test. A satisfactory seal was considered to have been obtained if a significant amount of the tear gas did not enter the facepiece or, in the case of the OBA, if the breathing bag did not collapse. The tests showed that of 33 personnel who had beards or sideburns and were wearing MK5 gas masks, 36 percent failed to maintain satisfactory seals rendering the masks ineffective. Fifty-one bearded personnel were tested wearing the OBA and 35 percent failed to maintain adequate seals.

"It was noted that even though some bearded personnel were able to maintain a satisfactory seal when tested, it is likely that as the beard grows or is trimmed this ability would no longer exist. Naval Safety Center has other supporting evidence, some based on 'in-leakage rates' which shows, in general, that beard growth compromises the safe use of most types of respirators.

"In order to provide adequate protection to the OBA gas mask wearer and to insure a more effective damage control team, personnel who are assigned duties involving the wearing of a breathing apparatus should not have beards or sideburns that will negate their effectiveness."

NAVSHIPSYSCOM letter 01G:CE3:avh, 5100, 25 June 71, to Chief of Naval Personnel states that personnel should be warned that beards are incompatible with present respiratory protection devices and that the degree of protection expected may not be realized.

In addition to the information in the original BESNL article and the Ships Safety Bulletin article quoted above, still another "safety implication" has come to our attention through a recent injury report (OPNAV 5100/1). In this case, a rescuer proceeded to revive a bearded unconscious victim by mouth-to-mouth resuscitation. A good mouth-to-mouth seal, necessary for full lung inflation, was difficult to obtain because of the mustache/beard! The victim was eventually revived but with great difficulty.

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Biosafety Notes from Aerospace Medical Association Meeting

This year's annual meeting was held in mid-71 at Houston. Subjects of biosafety interest covered in papers and associated discussions included various health/safety studies related to life support equipment, accident/injury statistics, bio-environmental medicine, hyperbaric (underwater) physiology, thermal stress, noise/vibration, radiobiology and flight safety. The following few items of interest are passed along to readers who did not have the opportunity to attend:

Color and reflectivity of sea survival equipment as related to shark attack. Further studies by the FAA (Protection/Survival Lab) and Naval Undersea R&D Center (Marine Bio-Sciences Division) indicate that survival equipment such as life vests and rafts should be dark and non-reflective as a deterrent to shark attack. Black non-reflective surfaces were considered best according to the experimental data which included movie films of dummies in various attire in shark-infested waters. A reason given to support this finding: Sharks have little color vision and not much visual acuity but readily detect and are attracted to contrasting and highly reflective colors.

Air Force studies on restraint systems. Evaluation of the effect of three restraint systems as protection against impact injury (using dummies) indicated that the air bag plus lap belt is the most protective of the systems studied.

Effect of noise and vibration on mental performance as a function of time of day. Investigation by the Air Force Aerospace Medical Research Lab showed that a noise level of 105dbA can cause some mental decrement (problem solving used as a test) at mid-afternoon (1500) whereas this decrement was not significant at 0600. This suggests that future research in extra-auditory effects of noise should take into consideration the time of day and that "circadian rhythm" may be a factor.

Time of useful function (TUF) after exposure to serious contaminants. McDonnell-Doughas Aircraft Corporation has started studies on this and the data could be extremely useful for reference in investigating injuries/fatalities resulting from acute overexposure to toxic agents such as CO, CO_2 and avgas.

Effects of carbon monoxide on cardiac response. Data presented by the Air Force School of Aerospace Medicine show that in cases of hypoxia the presence of small amounts of carbon monoxide (CO) aggravates hypoxia's adverse effects on the heart/circulatory system. There is a MIL-STD-800 on control of CO in aircraft. This new research gives more reason for concern about this contaminant in high altitude aircraft and for adhering to the requirements of MIL-STD-800.

Hyperbaric physiology. A few papers and discussions dealt with proper decompression profiles to prevent decompression sickness. Several related to prevention of bends in personnel who fly to high altitudes after diving. Recent experiments indicate that current Navy standards, such as the restrictions on flying after diving contained in General NATOPS, OPNAVINST 3710.7F are most appropriate and safe.

A few additional experiments were reported on in the search for a drug/chemical which would be beneficial in preventing decompression sickness. One exciting prospect is a drug called MA-1050, manufactured by Miles Laboratories. Mt. Sinai School of Medicine in New York performed much research on this. Injection of this material into animals prevented bends which would normally occur after certain hyperbaric exposures. The drug is claimed to interfere with SMAF (smooth muscle actuating factor) which causes other physiological factors leading to decompression sickness. The material has not been used on humans; more research is continuing. If such a material could ultimately be found safe and useful in humans, it could possibly be used as an emergency procedure for a necessary emergency deep diving operation known to be otherwise dangerous to health.

Thermal radiation protection. Research data presented by the Naval Air Development Center (Drs. Stoll and Chianta) show that metallic screening in protective

garments such as nomex suits provides for lateral dissipation of heat. This approach would be useful to nuclear flash protective clothing. Some time ago the Naval Safety Center encouraged NAVAIR and NAVSUP (R&D unit on protective clothing) to investigate the use of fine stainless wires woven into fabric for use as an anti-static treatment, with possible additional advantages of extreme heat protection and radar microwave protection. Current research appears to be proving the worth of metal fibers in clothing for heat dissipation and anti-stat treatment.

Microwave hazard--fact or fantasy. A panel representing the Navy (BUMED), Army, Air Force and Public Health Service discussed at length views on whether radar microwaves constitute a hazard or not, and if so at what levels. Long discussions only proved that in this country there is need for much more investigation and research to determine what effects (physiological and otherwise) occur at what levels of radiation. U.S. researchers appear not to accept East European data on this subject, which are extensive. U.S. standards on permissible levels of RF radiations are not based on firm data and generally apply only to potential eye injury. BUMED has established a Non-Ionizing Radiation Biomedical Development Plan under which research will be conducted to acquire better data on biomedical hazards.

-J.M.

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Safety Precautions for Handling Aerosol Cans

At a naval shipyard a fourth year apprentice pipefitter was about to spray-paint a waveguide tube section with a zinc chromate primer. The spray valve on the aerosol can of primer did not work when he pressed it. Thinking he could "loosen the paint," he placed the can in a vat of boiling water used in cleaning waveguide tubes before painting. Water temperature in the vat is kept between 180° and 212° F. He let the paint can float in the boiling water from 30 seconds to a minute, then reached down to remove it. As he did so, the can exploded, blowing both ends out. A fragment struck him on the forehead and boiling water splashed in his face and on his body and right arm. He sustained a corneal burn of the eye and scalds on his arm. Days lost totaled 24.

Aerosol containers can become aerosol bombs because they are "gas operated." When a product is put into such a container, a propellant, usually a liquified gas under pressure, is sealed in with it. When you press the spray valve, a portion of this liquified gas vaporizes, exerting pressure which propels the material up a tube to the valve and into the atmosphere. Each time you use the aerosol can, more propellant is vaporized inside. Even when the can is "empty," it may still contain some of the propellant. This is the reason you must not throw an "empty" aerosol can on a fire. Any gas inside will expand until the can explodes with fragmentation.

A check of various safety publication lists and directives at the Naval Safety Center failed to turn up a Navy-wide directive on safe handling of aerosol cans. Some local naval installations have their own directives. Generally speaking, basic safety precautions for handling aerosols include the following:

. Remember the contents of an aerosol can are under pressure. Never puncture an aerosol can and never throw it into a fire or an incinerator. Do not rework aerosol cans or try to refill them.

. Do not store aerosol cans where the temperature goes above 120°F. Exposure to high temperature may cause bursting. Keep aerosol cans at room temperature, away from sunlight, radiators, stoves, hot water and other heat sources. Do not leave cans in locked automobiles or in car glove compartments or trunks. (See photo at right. This container of windshield de-icer was left lying in the luggage space behind the rear seat of a Volkswagen sedan. Direct rays of the sun through the rear window caused it to explode. The car was parked and locked so there were no injuries. The can was found on the front seat floor.)

(Photo courtesy of John Stewart, safety officer, Philadelphia Naval Hospital.)

. Do not smoke or allow open flame in areas where aerosol cans are in use.

. Do not inhale aerosol sprays intended for external use. Spray in a ventilated area. Generally with limited use of aerosol spray cans and adherence to manufacturers' precautions, no great toxicity problem exists provided good ventilation is maintained and the cans are used in an open area. However, when aerosols are being used in quantity, an appropriate respirator and/or an exhaust spray booth should be used.

. When using insecticide spray, keep your skin well covered and wash any exposed skin areas after spraying. Some toxic ingredients are readily absorbed through the skin.

. Do not spray aerosols near your eyes. If the spray accidentally gets in your eyes, wash them with generous amounts of water.

. Do not dispose of aerosol cans in wastebaskets or other general trash containers. Before discarding an aerosol container, hold the spray valve open until all of the contents and as much gas as possible have escaped. Check with your local salvage people on final disposition of empty aerosol cans.

Aerosols should be kept away from children. A Naval Safety Center safety engineer recently observed neighborhood children spraying aerosols from cans and lighting off the spray for a blowtorch effect. This is, as he informed the children's parents, extremely hazardous, not only because the flame can set fire to clothing and burn exposed skin but because it might flash back to the can which then could explode in the child's hand.

A number of deaths attributed to inhaling the contents of various aerosol cans have been reported in the press. Some of the products contained in aerosol cans, such as bug sprays and disinfectants, can be poisonous in themselves. However, even aerosol products which contain materials having a low order of toxicity can be deadly if inhaled directly or sprayed and condensed in a balloon or plastic bag from which liquid is poured into the mouth. (Please see "Fatality Associated with Freon Sniffing," BESNL 1-71, p. 18.)

The American Heart Association, in its Spring 1971 Heart Research Newsletter, announced that two AHA research grantees, working independently, have completed experimental animal studies that point to the fatal mechanism: irregular heart rhythms triggered by the gas used to propel the sprays. The most common propellent is freon. The AHA-supported studies suggest that the gas alters the electrical conduction system of the heart, causing changes in heart rate, thereby raising the

specter of complete cardiac standstill. One of the researchers advised that everyone who uses an aerosol spray do so only in well-ventilated areas to preclude any accidental heart arrhythmias (heartbeat irregularities). The second researcher said prompt external cardiac massage and mouth-to-mouth resuscitation may help revive the victims.

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Asbestos Hazards and Their Control

BUMED/NAVSHIPS are continuing in efforts to control exposures to hazardous asbestos dust. Use of certain asbestos-containing insulation materials for repair and overhaul of Navy ships has been discontinued. Rules and recommendations for control of asbestos exposures are contained in a recent NAVSHIPS Instruction. Shipyard industrial hygiene divisions are active in various personnel protective schemes and in making dust counts to document the extent of exposure. Two shipyards have reported favorably on use of throwaway paper coveralls to prevent personal contamination during insulation "rip-out" work. (The coveralls are disposed of with other asbestos debris in a controlled manner.)

The search by Dr. I. Selikoff and the Environmental Sciences Lab, Mt. Sinai School of Medicine, N.Y. for a comfortable dust respirator which is highly protective and acceptable to insulation workers has led to development of certain prototypes. A disposable half-mask respirator which meets Bureau of Mines approval requirements for this hazardous dust is now available and being evaluated by at least two naval shipyards.

If you are concerned with the asbestos problem, we would suggest you have the following documents for reference:

NAVSHIPSINST 5100.26 of 9 Feb 1971 (Asbestos Exposure Hazards; control of)

NAVSHIPS Notice 9390 of 23 Feb 1971 (Asbestos Hazard; reduction of)

Bioenvironmental Safety Newsletter (2nd Qtr 1969), article on "Asbestos Hazard--What We Know and Don't Know." (This article summarizes some useful bio-safety information on the subject not contained in the other references.) -J.M.

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Drug Exemption Program

By SECNAVINST 6710.2 of 9 July 71, the Secretary of the Navy established a drug exemption program for all members of the naval service. Details of the program are set forth in CNO message 150014Z of July 71. The purpose of the program is to enable a drug user or possessor to obtain needed medical and other rehabilitative help without fear of disciplinary action under the Uniform Code of Military Justice or separation from the service with a discharge under other than honorable conditions.

Navy policy is that all Navy men will be given assistance in overcoming drug abuse problems, regardless of whether or not a Navy man has applied for exemption from disciplinary action or undesirable discharge. The Navy Drug Rehabilitation Center has been established at NAS Miramar primarily for the treatment and rehabilitation of individual abusers of hard narcotics and dangerous drugs. It is anticipated that a similar center will be established on the East Coast. Individuals who are identified as having drug abuse problems with drug substances such as marijuana or hashish should initially be counseled and treated at the local command level or a locally established drug control center.

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Miscellaneous Occupational Health Hazards--Recent Naval Experiences/Problems/Solutions

(The writer is indebted to BuMed Occupational Health Hazards Release No. 66, 1 July 1971, for much of the following material.)

Periodic Physical Examinations/Coordination with Occupational Exposure: NAD Crane reports on a practical method being used for recording personal exposure to hazardous materials/conditions on a continuing basis. A cumulative record is kept on each indiviudal which includes periodic physical examination data. This is cross-filed with an exposure history card and chronological records of air sampling results for each work area, making the evaluation of periodic exams for persons in hazardous occupations easier to accomplish.

Copper Salt Ingestion: An enlisted man inadvertently took a quick swallow of "green" metallic-tasting water from a drinking fountain and within 30 minutes experienced nausea, vomiting, abdominal cramps and later diarrhea--symptoms typical of copper poisoning. (Please see "Party Safety: The Champagne/Punch Bowl," page 17 this issue.) In this case it was conjectured that copper salts formed from longtime reaction of slightly acidic water on the copper coils in the drinking fountain and some of these salts were dislodged into the water by surges in the main water lines. The problem was solved by replacing the drinking fountain.

Benzene: A routine check by industrial hygiene personnel revealed extensive use of benzene in a naval shipyard. It was suggested that toluene, xylene or "benzine" (a petroleum naptha) be substituted. The Naval Safety Center made an investigation about two years ago and found an unwarranted use rate of this poisonous chemical Navy-wide. Operating forces and shore facilities were alerted to this misuse. Readers are reminded of the current BuMedInst 6270.2A of 16 Dec 1970, Benzene; health and safety hazards of, which states "The use of benzene aboard ship is prohibited. The use of benzene at naval shore activities is restricted to requirements for laboratory reagents."

Carbon Monoxide from Forklift Trucks: A problem arose related to inhalation of exhaust "fumes" from forklift trucks operating on the hangar deck of a carrier. Measurements indicated personnel were exposed to concentrations of 5 to 200 ppm of carbon monoxide and 0 to 5 ppm of nitrogen dioxide. While these levels would be considered permissible for short periods for industrial workers, it was pointed out that the amount of exhaust (and contaminants) can be quite variable and is related to climatic conditions, workload, etc. It was recommended that forklift trucks equipped with catalytic exhaust oxidizers (exhaust purifier) be used on hangar decks. Recollection of many past incidents of this type (on ships and in buildings) indicates the ultimate solution is in the procurement of the equipment. For this reason the Naval Safety Center in commenting on a newly proposed MIL-STD on general design criteria for handling equipment has suggested that types of equipment emitting toxic by-products, such as produced by internal combustion engines, should not be procured for use in interior close spaces unless specific provisions are made for adequate control of the interior environment so that Threshold Limit Values are not exceeded. An obvious solution is use of electric-powered forklifts where this is possible and practical.

Spray Painting (Large Aircraft): Eye irritations and respiratory complaints developed at one Navy activity during compressed air spray painting of a large

aircraft. Down-draft ventilation with exhaust grilles in the deck was insufficient for the work, as evidenced by high solvent vapor levels measured in the spray painter's breathing zone. Attempts to wear protective goggles were given up because paint overspray obscured the lenses. Further tests indicated that airless spray produced no perceptible overspray and much lower solvent vapor concentrations in the painter's breathing zone and permitted use of either goggles, face shield or full-face mask without vision impairment. Recommendation was made that consideration be given to use of airless spray painting methods.

Inhalation Hazards and Symptoms: The following are examples of toxic inhalation episodes which occurred at one ammunition depot during a six-month period. Symptoms described for ammonium picrate are for four individuals, indicating the variable response of different persons to the same chemical.

Causative Agent	Symptoms
Octol	Hot, weak, nauseated
Pyrotechnic Mixtures	Upper respiratory irritation
Stoddard Solvent	Nosebleed
Chloroform	Drowsy
Smoke	Headache
Steam	Dyspnea, cyanosis
TNT	Dizzy, nauseated, headache
Grit Blasting Dust	Difficulty breathing
CH-6	Light-headed, chills
R.D.X.	Headache, amnesia, unconscious
Composition "B"	Nausea
Fungus	Chest Pain
Ammonium Picrate	Headache
	Hot, dizzy, dyspnea
	Upset stomach, vomiting
	Headache, nausea, diarrhea

Lead Absorption: An employee in a naval shipyard became ill after a week's work involving milling (machining) of lead-based babbitt metal used in manufacturing bearings. He had not worn a respirator or used exhaust ventilation. He complained of abdominal cramps, nausea and chills. Urinary tests for lead indicated lead absorption. Symptoms subsided and one week later urinary lead levels were significantly reduced. Attention was called to precautionary measures for lead work such as use of approved respirator, ventilation and strict housekeeping measures. We would suggest that naval activities performing any lead work which have not issued an instruction on the subject contact one of the naval shipyards for a copy of the shipyard instruction on lead hazard and precautionary measures. These instructions which have been prepared by shipyard industrial hygiene/safety divisions could serve as a model for your local instruction.

Otto Fuel Disposal: In an operation in which Otto Fuel was being disposed of by burning in an open outside area, some fuel spilled on an employee, wetting his ear and chin and part of his clothing. He later denied that he had a headache or nasal stuffiness, symptoms which are general indicators of overexposure to the chemical. He put on a charcoal filter mask and rubber gloves and continued working. A short while later he became nauseated and faint. A fireman arrived at the scene, "washed the man down with a fire hose" and transported him to the dispensary. Medical opinion was that the man suffered a combined effect of Otto Fuel absorption and heat.

For the reader not familiar with Otto Fuel, this material is a liquid propellant for torpedos composed of a nitrate ester in solution with a desensitizing agent and a stabilizer. Workers overexposed to the material exhibit the usual "nitro" headaches shown by those exposed to nitroglycerin and ethylene glycol dinitrate. Safety, storage and handling precautions for this material are covered in NAVORD Technical Manual OP3368 (Nov 1969). The material is toxic by all routes of absorption, including the skin.

TDI Sensitization: A naval ordnance station reported on a case of hypersensitivity to TDI (toluene-diisocyanate), a liquid chemical used in making polyurethane type plastic. When exposed to TDI, the individual choked and coughed. He found no relief or protection in using an organic vapor respirator and it was found necessary to restrict him from all TDI operations. Conclusions drawn were that 1) vapor respirators will not prevent all individuals from developing a sensitivity to TDI and 2) respirators do not provide protection to those persons with histories of TDI sensitization.

The hazards of this material and medical requirements for personnel assigned to work with the material were addressed by the Naval Environmental Health Center in BESNL, 3-71 in an article titled "Dangers of Polyurethane Foam Processes."

Organotin Coating--Hull Application: Workers applying this antifouling coating to the hulls of two submarines sustained minor eye injuries due to inadequate eye protection. Medical Department evaluation of this incident led to reaffirming the need for strict adherence to written instructions on protective devices required when working with this type material. Also recommended was adherence to an established policy of minimum work on the hull after application of the antifoulant. The organotin in this coating was reported to be present as tributyl tin oxide. Various organotin compounds are toxic and capable of causing chemical burns. Some are very irritating to the skin, eyes and respiratory system. A review of the hazards of this type material appeared in BESNL 3-70 under the title "New Hull Coating (containing tributyltin acetate): Hazards and Precautions During and After Application."

Serum Hepatitis in the Clinical Laboratory: The following precautionary statements come from the National Naval Medical Center. The occupational hazard and risk of acquiring serum hepatitis is inherent in laboratories handling human blood. The infective agent is found in blood of patients with hepatitis. Technicians handling blood specimens may inadvertently contaminate their hands with the infective agent. Because of the risk of transferring the agent, drinking, eating and smoking in the laboratory are forbidden. Frequent handwashing and general laboratory cleanliness are encouraged and technicians with obvious cuts on their hands are instructed to wear disposable plastic gloves. Mechanical pipetting instruments are used in place of oral pipettes, whenever possible.

Nitrogen Oxides (from Heating Metal in Confined Spaces): Industrial hygiene personnel at the Bremerton Naval Shipyard conducted experiments related to proposed removal of propeller shafts from an aircraft carrier by the method of heating the bearings and sleeves with broad-flamed oxyacetylene torches. The purpose of the experiments was to determine the build-up of toxic nitrogen dioxide (NO_2) gas in the space (shaft alley). The space had a volume of about 4000 cubic feet with typical exhaust ventilation (four 5-inch exhaust ducts placed in the general work area). Heating was to continue for 30 minutes. In spite of ventilation,

after 20 minutes the NO_2 built up to a concentration of more than 100 ppm, a level which can be considered "immediately hazardous to life." In addition to the ventilation provided, all workmen in the compartment were required to wear air-fed respiratory protection for this and subsequent shaft removal jobs. It was stressed that they should continue to wear air-fed respiratory protection for at least 30 minutes after such a heating operation is completed.

The above findings and precautions are considered very important and can be related to other large scale operations where extremely high temperature flames or non-shielded arcs are used for heating large areas of metal surfaces in confined spaces. The following statements from Hunter's Diseases of Occupations are applicable: "At the temperature of the electric arc (about 3000°C), atmospheric O_2 and N_2 combine to form NO_2...in confined spaces fatal poisoning has resulted." NO_2 is sometimes referred to as a "sinister" type of gas, since it can be breathed with only slight inconvenience in concentrations which will cause fatal edema of the lungs.

Dermatitis Prevalence: One installation reported an occurrence of 91 occupational dermatitis cases due to exposure to skin irritants and sensitizers during a six-month period. Body location of the "rashes" included neck, face, hands, arms and other areas. Causative agents included Stoddard Solvent, acetone, trichloroethylene, naptha, paint thinner, epoxy resin, acids, various explosive chemicals, dyes, welding (conjunctivitis of eyes), friction blisters, rope rash, fiberglass (itch), insects, coveralls, poison ivy, heat rash, wet feet and carbon paper.

Dermatitis Prevention: (1) NARF Norfolk. The following refers to a dermatitis control program which exists at the Naval Air Rework Facility (NARF), NAS Norfolk and is excerpted from a report by the NAS senior industrial hygienist.

"It has been a policy to encourage liberal use of medically acceptable protective creams and skin conditioners. Only powdered soaps containing no free alkali or mineral abrasive and containing excess lanolin and an (acceptable) organic scrubber are used in NARF shop areas. Medical department approval is required for purchase of protective creams, skin conditioners and hand cleaners. There is a requirement for personnel using epoxy materials to use protective creams, sleeves, aprons and gloves where possible and to have immediately available waterless skin cleansers to use when the skin is soiled with the material. Following use of the waterless cleanser washing with soap and water is required. The use of epoxies which utilize amine-type accelerators is avoided to the greatest extent possible since it has been found other types are less prone to cause dermatitis and to sensitize exposed individuals. Exhaust ventilation is provided for the mixing of epoxy materials in locations where feasible. Ample supplies of gloves suitable for different work conditions are maintained and their use is either mandatory or encouraged."

(2) PSNSY (Bremerton Naval Shipyard): A "tank" suit has been developed for protection against dermatitis from spray painting of epoxy paints. The industrial hygiene division assisted in design of a protective suit in which an air distribution system is built into a close weave twill coverall. Over 200 of these air-fed suits were manufactured by the shipyard sail loft. The suit was designed for use when irritating and sensitizing paint products are sprayed in spaces which are difficult to ventilate, such as tanks and voids. Since the suits have been in use, over 40,000 gallons of epoxy and polyurethane paint have been applied without a

single reported case of dermatitis.

Fire Resistant Hydraulic Fluid: An activity involved in health evaluation of a facility for pumping and handling hydraulic fluid has called attention to the fluid's toxicity and precautions necessary. The material was formerly known as "Cellulube 220," now available in trade name products such as "Fire Quell." Hazardous air concentrations of the vapor are unlikely at ordinary temperatures. However, when the fluid is heated to high temperatures or when mists or aerosols are generated, an approved respirator and local exhaust ventilation are necessary to prevent its inhalation. Contaminated skin should be cleansed immediately with soap and water or waterless hand cleaner. Butyl rubber gloves and impervious footwear are advised for personnel having repeated or prolonged contact with the material.

The report did not identify the chemicals but this material is described in MIL-H-19457B (Ships), Hydraulic Fluid, Fire Resistant as a "homogenous formulation of phosphoric acid esters and such other ingredients as required for conformance with this specification." Most readers are familiar with TCP (tri ortho cresyl phosphate) which is a very toxic liquid, responsible for hundreds of poisoning cases over the years by way of accidental ingestion. The above specification requires that the organic (triaryl) phosphate used in the hydraulic fluid shall not have a TCP equivalent greater than 25%. (The specification test for this involves observing the toxic effects of certain doses on the nervous systems of chickens (paralytic symptoms) in comparison to equivalent doses of TCP.) The point is that the material is required to be much less toxic than TCP to pass the specification but is still potentially hazardous and precautions should be exercised.

-John T. Maccioli
Naval Safety Center

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Ultraviolet Light Overexposure (A Plan of the Day Safety Note)

In a stateside barracks, a PR fell asleep under a sunlamp for 15 minutes...A YN3 became involved in a phone conversation for approximately 15 minutes while under a sunlamp in his apartment...A Wave on authorized leave at her home sunned too long under her lamp...In his barracks, an ADJAN exposed his head and face to a sunlamp for 15 minutes. All four were hospitalized for corneal burns of the eyes.

Because of the wavelengths and energies present, sunlamps are considered harmful both to the skin and eyes if exposure is direct, prolonged and at close range. Manufacturers' recommendations on the lamp packaging should be followed to prevent burns. It's fine to be tan but don't overdo it. You might permanently damage your eyesight.

(For a general discussion of ultraviolet lights, please see "Ultraviolet Lamps--Which Ones Are Potentially Injurious?" BESNL 4-71, pp. 3-6.)

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Health Maintenance and Safety

Every medical officer/medical department representative is responsible under the commanding officer for maintaining the health of the personnel of his ship. To fulfill this responsibility he must provide for the sick and injured the most careful professional attention and care consistent with the highest standards of modern medicine. He is in direct charge of the sick and injured. It is his duty to conduct health educational programs in the areas of hygiene and sanitation, venereal disease and first aid instruction for the officers and men of his ship. Also, he must review the health records of the crew to become familiar with those members with significant physical defects or history.

When a crewmember is considered to be physically unfit to perform his assigned duties because of injury or illness, he may be admitted to sick bay for treatment, further evaluation and appropriate disposition. In many cases the injury or illness is considered minor and the crewmember may be returned to duty and be treated on an out-patient basis. However, since today's Navy man lives and works in the inherently dangerous environment of modern ships which are furnished with complex and sophisticated machinery it may be necessary to limit an out-patient's activities during the period of his treatment.

One of the contributing factors in many injuries is the presence of pre-existing disease or injury. In 1970 the Naval Safety Center received 56 Accidental Injury/Death Reports (OPNAV Form 5100/1) in which pre-existing disease or injury may have been a contributing factor. For example a man was standing on a ventilation duct chipping paint when a previously injured knee gave away and caused him to fall. He had sustained a tear of the medial collateral ligaments. The cast had been removed seven days before and he was still using crutches. It is very apparent that this man should have been continued in a light duty status until his knee had fully healed.

It may be necessary to restrict a patient from performing his routine duties or to remove him from the environment which caused or contributed to his injury or illness. The limitations of an out-patient's activities depend upon his normal duties. A deckhand with a back injury would be restricted from duties involving heavy lifting; a machinist taking a medication such as an antihistamine should be prevented from operating any machinery or equipment; a mess cook with a contact dermatitis of the hands should be removed from scullery or food handling duties.

Occasionally, the assignment of light duty or no duty for a short period of time will cause a hardship for the command. However, while the efficiency of a

shop or division may be affected if a man is taken off duty for a minor injury or illness, safety will be compromised if he remains on the job. The same can be said for a crewmember suffering from human stresses brought about by alcohol, drugs, emotional disorder or fatigue.

A crewmember who has indulged in intoxicating beverages, narcotics or dangerous drugs to such an extent as to impair the rational and full exercise of his mental and physical faculties cannot be entrusted with duties incident to naval service. Therefore, in cases involving possible intoxication, drug addiction, medication or other unusual exposures or circumstances, there is a need to know whether the person concerned is competent to perform his duty. The safety and welfare of the individual and his shipmates and the operational readiness of the ship may be seriously affected if an intoxicated or drugged man is allowed to return to his work.

BuMedInst 6120.20A provides information regarding the use of NavMed Form 6120/1, Competence for Duty Examination. This form is designed to assist the medical officer in determining an individual's competence for duty when requested to do so by proper authority.

During the 18-month period from July 1969 through December 1970 a total of 212 Accidental Injury/Death Reports were received at the Safety Center which cited alcohol or drugs as a factor contributing to the mishap. Of these, 27 deaths were attributed to alcohol or drugs. (These statistics do not include automobile accidents.)

There are no statistical data available as to the proportion of injuries which may be attributed to hangovers. However, we must assume that hangovers are responsible for many accidental injuries for common sense tells us that the tense, fuzzy and slow-thinking hangover victim is incapable of normal mental and physical functions.

Medical department personnel are aware that some members of a crew suffer from emotional disturbances which affect their day-to-day performance. Failure to adjust to shipboard environment is manifested by disturbance in some part of the personality, either as bodily symptoms of various kinds or as affections of the spirit resulting in attacks of anxiety, obsessions, phobias, depressions and other disturbances of mood. Treatment for this type of patient requires more than the usual examinations, laboratory tests and medications. It is essential that the medical officer/medical department representative get to know the patient as a human being rather than just another sick call case. Many times an emotionally disturbed man may commit deeds which endanger himself, other members of the crew and the safe operations of the ship. By getting to know this type of individual, the medical department can more readily make the right judgment in determining the necessity for psychiatric treatment.

All of the factors discussed herein have a bearing on personnel safety in the Navy. Personnel safety is the special and continuing responsibility of all medical department personnel.

-HMCS Norman D. Walker, USN
Naval Safety Center

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Turned On Laundry Machine Hospitalizes PO2

A chief machinist's mate on a CVA was notified that a flywheel nut had vibrated loose on a 200 pound washer unit in the ship's laundry. The chief assigned an MM2 to go to the laundry to repair the machine. He obtained the necessary tools and proceeded to the laundry where the normal operating schedule was in progress. The machine which needed repair was loaded with clothes but was turned off.

The machinist's mate was behind the machine tightening the flywheel nut when a second MM2 joined him and started talking. At this time a laundryman, unaware of the presence of the two men behind the machine, turned the unit on. The repairman's right arm was caught between the turning flywheel and drive belts, twisting his upper torso and dislodging two of the belts. His head struck the protective caging next to the drive belt assembly. The second MM2 immediately deactivated the machine and the injured man was taken to sick bay. He had sustained fractures of the right forearm, wrist and lower jaw as well as lacerations of the scalp.

This accident was a human factor accident, pure and simple. Inspecting and tightening washing machine nuts and bolts is a routine procedure in the CVA's steam heat group weekly planned maintenance. Directives specify that before maintenance or checks are performed, machines are to be de-energized and tagged "out of service." This precaution had been verbally stressed by the chief machinist's mate, investigators reported. A clearly marked master circuit breaker panel controlling the machine involved in this accident is located in the laundry. Even though laundry work was in progress at the time and a man tightening a washer flywheel nut cannot be seen from the front of the machine, the repairman disregarded basic safety precautions and precipitated the accident.

Behind every safety precaution there is a very good reason. Shortcuts cause injuries.

-HMCS N.D. Walker, USN
Naval Safety Center

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Safety Plate on Printing Press Removed

"Added caution is not an adequate substitute for correct protective equipment," a ship's safety officer wrote in his report on a hand injury.

In the ship's print shop, an LI3 was adjusting gears on a printing press when his finger slipped and was caught in the gears. The safety plate designed to prevent such an accident had been removed by personnel previously working in the print shop and thrown away because it made oiling the machine a lengthy process. At the time of the accident the shop supervisor had a safety plate on order but it had not yet arrived.

"There is no excuse for an accident of this nature and every effort is being made to ensure that there are no recurrences," the safety officer wrote. "All were aware that the guard was missing and were additionally cautious because of it. The accident occurred despite this and reconfirms the fact that added caution is not an adequate substitute for correct protective equipment."

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Hazardous Materials and Their Stowage Aboard Ship

Just what is a hazardous material or chemical? If it can cause injury or illness to people, if it burns, if it is corrosive, radioactive, reactive or oxidizing or even magnetic chances are it is hazardous. For more detail, check the Consolidated Hazardous Item List (CHIL) (NAVSUP Publication 4500, dtd 1 April 1971). In addition to information on hazardous material, labels, etc., it has three lists of items: One in stock number sequence, another in nomenclature sequence and a third based on ship stowage requirements. NAVSHIPS Technical Manual Chapter 9300 and Supply Afloat (NAVSUP 485) have more information on the stowage of dangerous materials; these references refer to the hazardous category of materials and the degree of hazard.

At the top of the hazardous list in the documents are six items which are not to be stored or used aboard ship; they are: benzene (benzol), tetrachlorethane, carbon tetrachloride, hydrocyanic gas, DDT xylene (emulsion) and methylbromide. Since these are chemical names, make sure you don't have or don't order these materials under a trade name.

Most materials classified as dangerous or semisafe, whether or not in sealed containers, are fire hazards and should be stowed in authorized paint and flammable liquid storerooms. The quantities held should be the absolute minimum to meet anticipated requirements. If upon inspection you notice solvents, chemicals, thinners, varnishes, lacquers, liquid cement, alcohol, ether or naphtha stored elsewhere--check it out in the CHIL--and see that the material is moved.

Additionally, there are special storage requirements for acids, alcohol, calcium hypochlorite, compressed gasses, gasoline and radioactive tubes. Acids generally require lead-lined lockers in lead-lined storerooms below the water-line. Ethyl alcohol (ethanol, grain alcohol) stock also requires a locker but in this case it should be in the custody of the supply officer or medical officer and physically located in the paint and flammable liquid storeroom. Regulations do not require methyl alcohol (methanol, wood alcohol) to be stored within the locker but it and its compounds, such as duplication fluid and "canned heat," should be kept within the paint and flammable storeroom. Remember that, in addition to being a fire hazard, methanol is toxic when absorbed through the skin or inhaled as a vapor and highly toxic (poisonous) when swallowed. Ingestion of methanol or ethanol denatured with a small percentage of methanol can cause death or blindness.

A number of chemicals on the list are oxidizing agents, including the dangerous calcium hypochlorite. These require separate stowage away from combustibles and readily oxidizable materials. Even in supposedly sealed containers, calcium hypochlorite can produce highly toxic chlorine gas. If you see it in a cleaning gear locker, a head, the galley or the laundry, it is in the wrong space! It should be stored in a clean, cool, dry space away from heat sources, magazines, acids and other chemicals and combustibles. Again check Supply Afloat (NAVSUP 485) for details. Several other shipboard chemicals, including skin-burning sodium hydroxide (lye) and flammable gas-producing calcium carbide, require a moisture-free environment.

Compressed gas cylinders should be secured in vertical racks on the weather decks, preferably shaded from the direct rays of the sun. Caps should always be in place. Two potential danger areas in this category are Freon 12 or 22 cylinders stowed loose below decks and gas welding outfits not secure at sea. Gasoline or

kerosene drums should be stowed aft on the weather deck, in racks, as prescribed in NAVSHIPS Tech Manual 9150. Even small quantities of radioactive tubes stowed together may present a radiation hazard. Check to see that storage areas in the ET shack and supply are marked with "Radiation hazard" labels and periodically monitored by the damage control assistant for radiation in accordance with Radiological Safety Regulations (NAVMED P-1325). Caution must be observed when handling broken tubes.

Safety in handling and storing hazardous materials can be a complicated matter or a relatively simple daily practice. Realize there are inherent dangers. Utilize safe storage facilities and, above all, show due caution.

- LT Phelps Hobart, SC, USN
Naval Safety Center

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Injury Causes Elimination of Long-Standing Hazard

Two broken fingers and correction of a "27-year-old design deficiency" resulted from an accident aboard a CVS.

A seaman was supervising breakout of frozen meat from a fourth deck reefer. While the men were working inside the inner reefer, he noticed that the outer door to the reefer had been left open and went to close it to stop the rapid loss of cold air. As he pulled the door closed, he caught his fingers between the door and the jamb. The U-shaped metal door handle was so close to the edge that when you pulled the door to, your fingers could be caught as it closed.

"This 27-year-old design deficiency in placement of the reefer door handle will be corrected by having a welder move the door handle approximately 3 inches further inside the door edge," the accidental injury report states.

Does such a hazard exist anywhere aboard your ship? Chances are that if it does people know about it and so far nothing has happened because they are 1) careful or 2) lucky. You don't have to have an injury before you correct a hazard.

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Shipboard Elevator Accident

Thanks to his safety shoe, a shore station employee got away with only a broken big toe when his left foot was caught between a freight elevator platform and the leading bottom edge of the third deck aboard a ship tied up at a pier. While riding the elevator up, he stood with part of his foot over the platform edge. As the elevator approached the third deck, his foot was caught.

Investigators reported that waterfront employees are being reminded of the extreme hazards of shipboard elevators. They are being directed to use the stairways to get from one level of the ship to another unless a fully guarded passenger elevator is available. Shipboard protection of elevators and their shaftways should be considered in design of new ships as well as for modification improvement on existing ships, investigators said. The employees' safety shoe is being used as a training aid.

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Pilot Experience and Pilot-Caused Carrier Landing Accidents

(Portions of the following paper by CAPT Earl H. Ninow, MC, USN, LT Norman E. Lane, MSC, USN and Gerald T. Eccles were presented at the 42nd Annual Scientific Meeting of the Aerospace Medical Association in Houston, 26-29 April 1971.)

Aircraft carrier operations have long been recognized as one of the most demanding and dangerous aspects of military aviation. Within this carrier environment, the carrier landing represents the most consistently difficult and challenging phase of a mission profile.

There are numerous factors which may serve to bring about or prevent a carrier landing accident at a given time. One factor which is generally considered to be of critical importance in avoidance of such accidents is the flying experience of the pilot. It is ordinarily assumed that pilots become less accident-liable as total flight time increases and that intensive recent flight experience serves to keep a pilot maximally proficient, reducing his accident likelihood. Experience factors are often weighed in assessing a pilot's readiness to perform a mission and thus have an effect on flight schedules and pilot assignments. Despite this importance of experience factors in the judgment of pilot proficiency, however, there has been little more than expert opinion or anecdotal evidence that pilot experience has any real influence on the safety of carrier operations. Adequately controlled studies are conspicuously absent due in large part to the difficulties of obtaining appropriate population exposure data for the carrier aviation community. With the introduction of the Individual Flight Activity Reporting System (IFARS) at the Naval Safety Center in Fiscal 1969, it has become possible to obtain selected flight history and flight activity information for the total naval aviation population and for selected subgroups of that population.

Utilizing data contained in IFARS and aircraft accident records, the present study compares experience variables for the population with those for accident pilots to determine the relationship of total experience and recent carrier experience to accident risk in the carrier landing situation.

Method

Accident Groups

The accident group in this study was composed of all pilots involved in major carrier landing accidents during Fiscal Years 1969 and 1970 in any of a selected group of jet fighter and attack aircraft: A-3, A-4, A-5, A-7, F-4 and F-8. A carrier landing accident was defined as one which occurred or became inevitable during the landing phase from the time the meatball was sighted until the aircraft passed over the forward edge of the angled deck. Accidents were identified as either "pilot-factor" or "non-pilot-factor" according to whether pilot error was assigned as one of the causal factors in the accident. Sixty-eight pilots compris-

ed the "pilot-factor accident" group and 43 were in the "non-pilot-factor accident" group, a total of 111 accident pilots.

Populations

To serve as control groups, two slightly different populations were drawn from the records of all active naval aviators. The first, called the "carrier-active" population, consisted of all Navy pilots having more than five carrier landings and more than 50 hours in one year in one of the aircraft under study. Data for both years were combined to produce a total two-year population of 4,073 pilots. The second, called the "fighter-attack" population, consisted of all Navy pilots having more than zero hours in one of the two years in any jet fighter or attack aircraft, excluding trainer versions. Again, years were combined to produce a total population of 8,503 pilots. Although the two populations differed slightly in composition and the second was around twice as large, there were no significant differences between the two with respect to the distributions of total experience in general or experience with the carrier environment.* The populations were thereafter used interchangeably with the larger group used when increased stability was considered necessary.

Total Experience

Two measures of total experience were employed -- 1) total hours all years and 2) years since designation as an aviator. The total-flight-hours-experience variable was used as the primary measure of total experience. Although neither measure is a direct representation of carrier experience, for a population of jet fighter and attack pilots total flight experience in hours and years should be highly and proportionally related to carrier flight experience. In examining the role of total experience in accidents, several measures of exposure were used to relate accident risk to observed accident occurrence, producing an indication of relative accident risk. The primary exposure base was percentage of total population at each experience level; also used as exposure bases to crosscheck findings were percentage of hours flown and percentage of annual carrier landings accomplished by pilots at each experience level.

Recent Experience

To study recent carrier experience, total carrier landings in the 30 days preceding the accident were obtained for individuals in the accident groups. For comparison with the population, the distributions of carrier landings by all individuals flying the previously mentioned aircraft were obtained for the 4th, 12th and 20th months of the two year period. These were averaged across the three months, providing a stable and representative distribution of 30-day landing history for a non-accident population.

Findings

Total Experience (Hours)

Findings on the role played in carrier accidents by accumulated flight experience both support and refute some traditional ideas on the subject. It is commonly assumed that the most dangerous period of a carrier pilot's career is the

* Throughout the paper, a significant difference is defined as one for which distributions were statistically different with a probability of .05 or less, as determined by Kolmogorov-Smirnov tests.

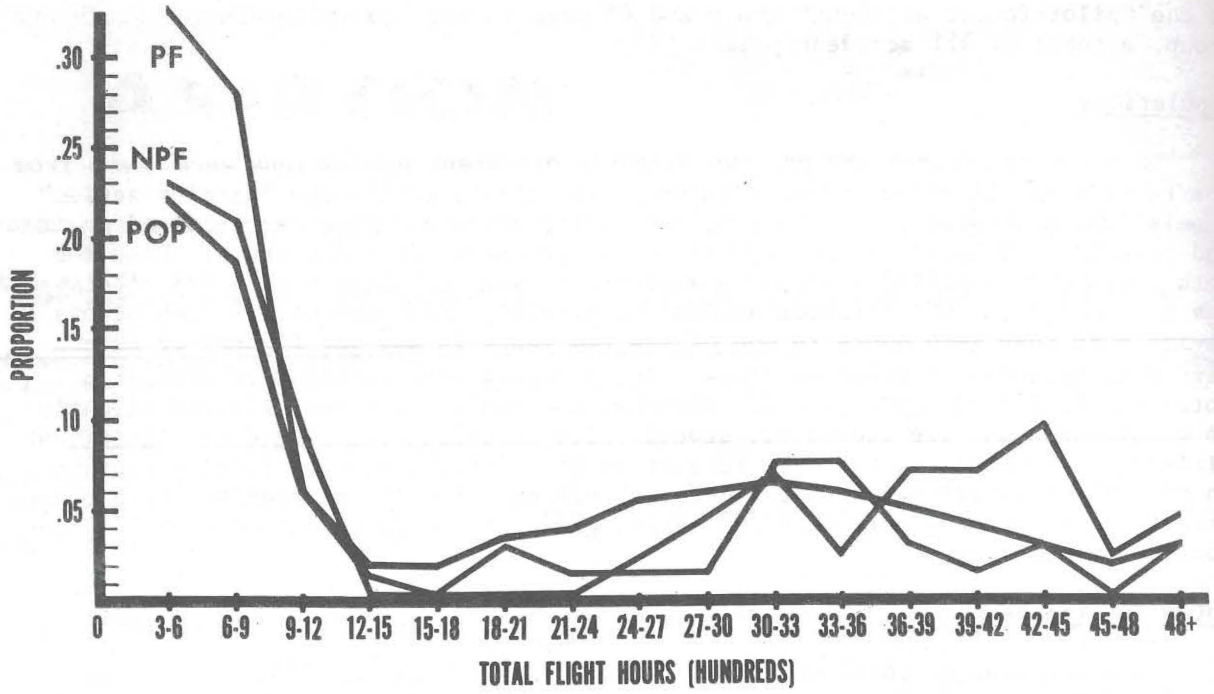

Figure 1

Pilot-Factor and Non-Pilot-Factor Accident Occurrence and Exposure By Total Flight Hours – Carrier-Active Population, FY 69 and 70.

first 500 to 1000 hours during which his experience is insufficient to build up a margin for error and his accident likelihood is high.

As Figure 1 shows, this assumption is supported by comparison of the pilot factor accident group (PF) to the carrier-active population (POP). Aviators with 300-600 hours and 600-900 hours have about 50 percent more than their expected pilot-factor accidents. This period of 300-900 hours would usually cover the first two years of an aviator's carrier-based tour. It has often been suggested that another dangerous time for an aviator is the 1000-1500 hour period, about the third year of flying, during which, it is held, his confidence may be greater than his ability. As Figure 1 shows, however, quite the converse is true. Past 900 hours, the pilot factor accident curve drops sharply and stays below the exposure curve until around 3000 total hours is reached.

Individuals in the 1200-3000 hour experience groups comprise a relatively low proportion of the population. The majority of these individuals, designated from 4 to 7 years, are serving in staff or training billets and are not in the carrier-active population. Those who remain, however, comprise by far the safest group with respect to relative accident likelihood. Pilots in the 1500-3000 hour range have less than one-third of their expected pilot factor accidents.

At experience levels of 3000-3600 hours, a striking increase in relative accident risk is noted. These are individuals returning to active carrier flying after three or four years in other flying or staff jobs. (This phenomenon can be seen more clearly in Figure 2.) Pilots in this experience range have about 20 percent more pilot-factor accidents than expected, a drastic change from the preceding experience level of 2700 to 3000 hours for which pilot-factor accidents are about 75 percent less frequent than expected.

Also of interest in Figure 1 are findings on the relative risks of non-pilot-factor accidents (NPF). The risk of such accidents follows the same trends as do pilot-factor mishaps up to the 3000 hour level. Past that point, however, there is a tendency for a decrease in pilot-factor accidents within a level to be associated with a corresponding increase in non-pilot-factor accidents. This phenomenon is most clearly seen in the 3600-4200 hour range, in which pilots have two to three times the expected number of non-pilot-factor accidents. Two possible explanations for this excess of non-pilot factor accidents in more seasoned aviators can be advanced. The first, and more obvious, is the possible reluctance to perceive pilot error in a senior pilot, given the same mistake for which a pilot-error tag would be almost automatic for a more junior man. This charitable tendency would explain the increases in one accident type associated with decreases in the other. An alternative explanation is that senior aviators tend to fly the older or more poorly maintained aircraft on the assumption that they are better able to handle potential malfunctions than are beginning pilots. This hypothesis, however, is not consistent with the excess of non-pilot-factor accidents by junior pilots in the 300-900 hour range.

All of the trends above hold up when exposure is measured by percentage of hours and percentage of carrier landings instead of percentage of population. As would be expected, junior pilots fly a proportion of annual hours greater than their representation in the population but still show an excess of pilot-factor accidents. When exposure is measured by carrier landings, the increase in accident risk seen for pilots in the 3000-3600 hour range is more clearly defined; such pilots have about 40 percent more pilot-factor accidents than expected on the basis of their carrier landings.

Total Experience (Years)

When total flying experience is viewed on the basis of years of flying instead of total hours logged, the effects of career patterns on accidents are more sharply apparent.

Figure 2 shows comparisons of the pilot-factor and non-pilot-factor accident distributions to the population distribution by years since designation as an aviator. The last three points under "years DNA" are five-year groupings due to peculiarities of available data records and are not directly comparable to the preceding one-year intervals in terms of absolute percentages.

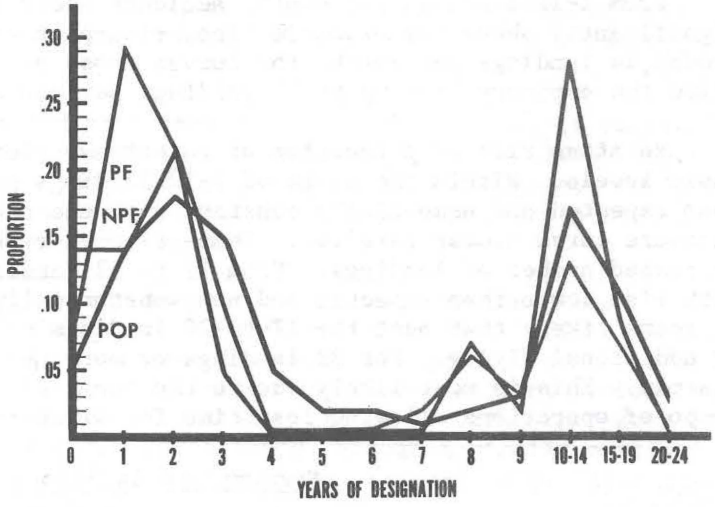

Figure 2
Pilot-Factor and Non-Pilot-Factor Accident Occurrence and Exposure By Years of Designation – Fighter/Attack Population, FY 69 and 70.

The surplus of pilot-factor accidents in the first two years of flying corresponds to that seen for the 300-900 hour range in Figure 1. Note the sharp drop in relative risk in the third year of designation and the total absence of any accidents at all in the fourth, fifth and sixth years. Pilots in these years

flew more than 110,000 hours without a major carrier landing accident. The tendency for relative risk to increase with a return to active carrier flying in the eighth year is also seen more clearly than when total hours alone are considered. Both pilot-factor and non-pilot-factor accidents occur at a rate about three times as great as expected with the risk dropping to average in the ninth year. Again, it can be seen that non-pilot-factor accidents are more frequent than expected in the 10 to 20 years experience group.

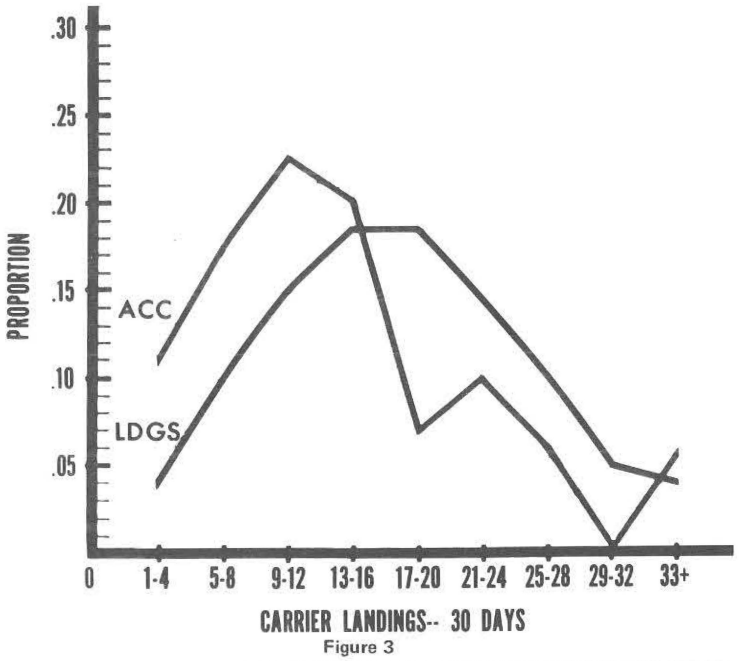

Figure 3
Recent Experience Accident Occurrence and Exposure By Carrier Landing History in 30-Day Period.

Recent Experience

Recent experience with the carrier environment is represented by the number of carrier landings in a 30-day period preceding either the accident or selected arbitrary points for the non-accident group. The exposure baseline consists of the proportion of total 30-day carrier landings accomplished by pilots at each level of monthly landing activity. It was found that the pilot-factor and non-pilot-factor accident groups were almost identical in distribution of the experience variable and the two groups were combined with results as shown in Figure 3.

From 1-12 landings per month, accident occurrence stays consistently and significantly above the exposure line, rising at the same rate as exposure. At around 16 landings per month, the curves cross and accident risk stays consistently below the exposure line up to 32 landings per month.

Relative risk as a function of recent experience appears to divide into two basic levels. Within the range of 1-12 landings per month, relative risk is higher than expected and essentially constant with the accident occurrence curve and the exposure curve almost parallel. Thus relative risk is changing only slightly with increased number of landings. From 17 to 32 landings, the same relationship holds with risk lower than expected and not substantially affected by increased landings. It seems likely that past the 17-to-20 landings range, proficiency is not improved by additional flying. For 32 landings or more per month, relative risk jumps sharply. This is most likely due to the onset of personnel fatigue and a faster tempo of operations allowing less time for aircraft maintenance.

Summary and Implications

Total experience is highly relevant in carrier safety but in a twofold sense. Pilots in their first two years of carrier aviation, up to about 1000 hours, show high relative risks of pilot-factor carrier landing accidents with a steady decrease in risk throughout this period. In the third year and more strikingly in the fourth through sixth years of flying, up to about 3000 hours, relative risk is

very low and carrier landing accidents are almost nonexistent. At around 3000 to 3600 hours, in the eighth year of experience, there is a sharp increase in relative risk as a large number of pilots return to active carrier flying after several years' layoff. Past the ninth year, risk of pilot-factor accidents decreases but is accompanied by a corresponding steady increase in risk of non-pilot-factor accidents.

Recent experience in the carrier environment as reflected by frequency of carrier landings was also shown to have a significant influence on carrier landing safety. The "break even" point for proficiency was about 13 to 16 monthly landings. Up to that point, accident risk was higher than expected but decreased sharply thereafter. The optimal frequency in terms of minimal risk was around 17 to 20 monthly landings, apparently sufficient to keep proficiency high without allowing degradation due to fatigue or other factors.

Several implications follow directly or indirectly from the findings of this study. The extreme vulnerability of very junior pilots suggests that additional care is necessary during initial carrier qualifications in fleet jet aircraft to avoid environmental or scheduling situations which produce less than optimal conditions in very early stages of an individual's carrier career. For marginal junior aviators during the qualification stages, every effort should be made to provide additional experience prior to the final qualification time. Although the value of carrier landing simulators has not been conclusively demonstrated, such simulators offer a potential means of intensive carrier landing practice without the accompanying increase in risk.

Experienced aviators returning to carrier aviation following other billets should be aware that their proficiency is substantially lower than when they left the carrier environment and their accident risks are correspondingly high. Until proficiency is regained, such pilots should try to become reoriented under the best conditions available and must be willing to accept and recognize their limitations. More refresher training than is ordinarily considered necessary for such individuals may be needed. Simulators may have a role to play in this respect also.

Findings on recent experience indicate that increased proficiency in carrier landings is not a straight line function of recent landings. Past a given point, little increase in proficiency is gained. If frequency becomes too great, fatigue may outweigh any gains in proficiency and accident risk will jump sharply with a two or threefold increase in accident likelihood.

In general, the results of this study support most of the common preconceptions of the role of long term and short term experience on carrier landing safety. Several findings, however, show that unrecognized hazards are present at certain experience levels. The significant impact of these hazards on accident probability suggests that efforts should be made to minimize risk to certain experience categories during acquisition of increased proficiency through maximally careful scheduling and by the use of simulators which provide an increase in proficiency without accompanying dangers of loss of aircraft and pilots.

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Leaking Inflation Assembly in Mk-1 Flight Deck Life Preserver

As part of the squadron's safety stand-down, an embarked VA outfit carried out an inspection of all pilots' and maintenance personnel's survival gear. Functional checks included inflation of the MK-1 flight deck life preserver by use of the CO_2 inflation assembly, MIL-1-23145(AS), Type III. On many of the life preservers tested, inflation could not be achieved due to leakage of gas from around the connection point of the inflation assembly and the buoyancy chamber. Further inspection revealed that the connecting point rubber washers were missing. Inspection of the remaining squadron flight deck life preservers disclosed that the rubber washers were missing on 50 out of 70 inflation assemblies. The rubber washers were missing on unissued inflation assemblies as well.

The squadron stated that the only available publication for maintenance of this equipment is NAVSHIPS Technical Manual 0901-331-0001, Chapter 9331 of February 1969 (Personal/Survival Equipment CROSSFEED 11-69 and 11-70 refer). None of the testing procedures provide for the inflation of the Mk-1 by actuating the CO_2 cylinders. It was also reported that the part number for the missing washer was unavailable. (A check with the Naval Ship Research and Development Laboratory revealed that there is no part number or federal stock number for the rubber gasket. It is understood that the Ships Parts Control Center, Mechanicsburg, Pa., will initiate action to assign a part number or federal stock number to this item.)

To remedy the reported discrepancy, the squadron PR's manufactured and tested a substitute washer made from neoprene life raft patches. The squadron also recommended that the information contained in NAVSHIPS Technical Manual 9331.31 and 9331.32 be incorporated in the Aviation Crew Systems Manual (Flotation Manual), NAVAIR 13-1-6.1 so that squadron and AIMD PR's will have available the information necessary for testing and maintenance.

-PRCM G.C. Kikos, USN
Naval Safety Center

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Navy Adopts Air Force Shroud Cutter

The Naval Safety Center has received numerous reports concerning accidental opening of the MC-1 pocket pushbutton survival knife. Some activities have stated that they wrap a short length of electrician's tape around the knife to prevent such an occurrence. This modification will not affect the primary function of the knife which is to cut shroudlines with the shroudline cutter blade.

The Naval Air Development Center has stated that in accordance with the decision of APSET (Aviation Personal Survival Equipment Team), the MC -1 pocket knife has been replaced by an Air Force type shroudline cutter , (P/N 60C6037, FSN 1670-779-1253LS) , which has only the shroudline cutter blade. The blade does not fold and is always exposed.

As an interim measure, NAVAIRDEVCEN concurs with the practice of taping the pushbutton knife to prevent accidental opening.

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Let There Be More Light
(Under Aircraft in Maintenance and Assembly Areas)

Two years ago in Approach (July, 1969) an article appeared with the title "Let There Be Light" in which, with the aid of photos, H.J. Worsham and J.T. Maccioli described a simple way to improve lighting in aircraft maintenance and assembly areas. The problem of getting sufficient illumination to the underside of aircraft was discussed, citing reported instances where illumination levels of nearly 20 foot-candles "struck" the deck but less than one foot-candle was reflected to the aircraft undersurfaces. The use of a highly reflective deck coating was shown to greatly enhance the illumination of these areas.

The safety benefits derived from such improved illumination relate to improved quality/quantity of work (much easier to see the work and more comfortable with less chance for error) and elimination of the FOD (foreign object damage) problem since foreign objects are easier to spot.

Since the Approach article was written, the Naval Safety Center has received many inquiries regarding the application of this method. Because of this and with new experiences developing, it is timely to say more about the subject.

The following figures 1-4 are reprinted from the original Approach article and show the improvement in illumination of the underside of aircraft after coating the deck under and immediately surrounding an aircraft; the "before and after" photographs were taken at night.

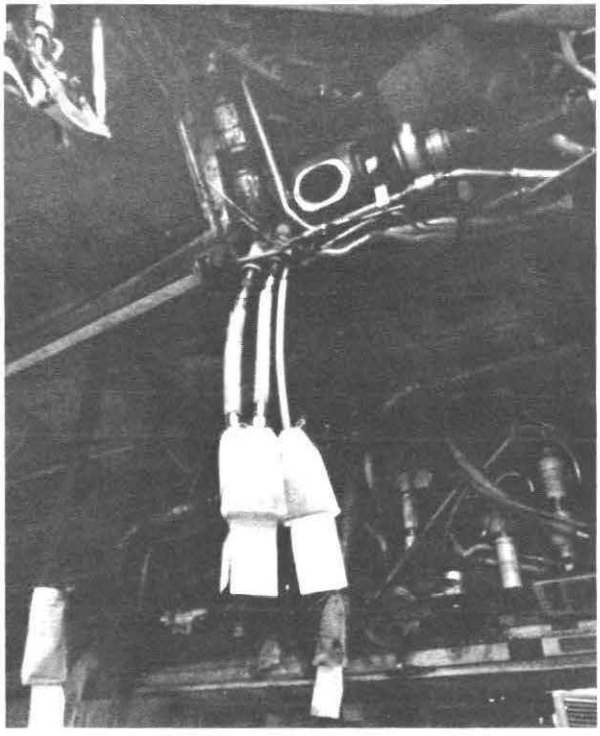

Fig. 1. BEFORE painting deck white.

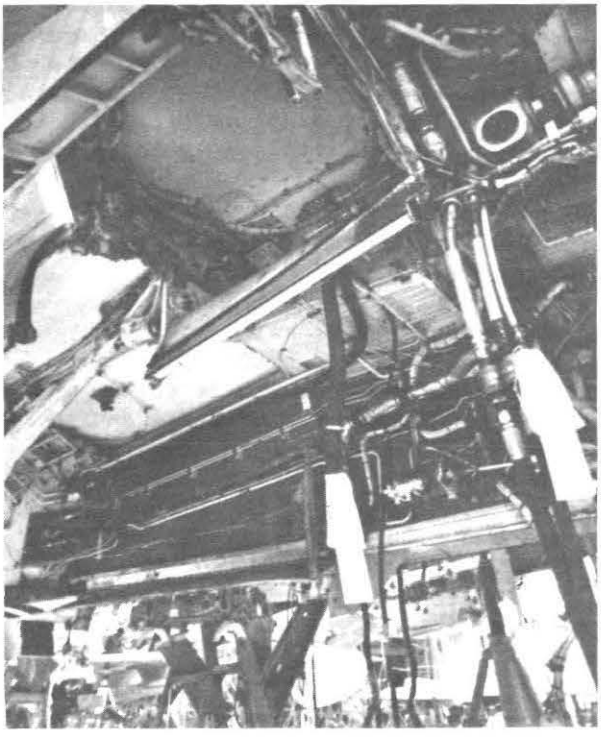

Fig. 2. AFTER painting deck white.

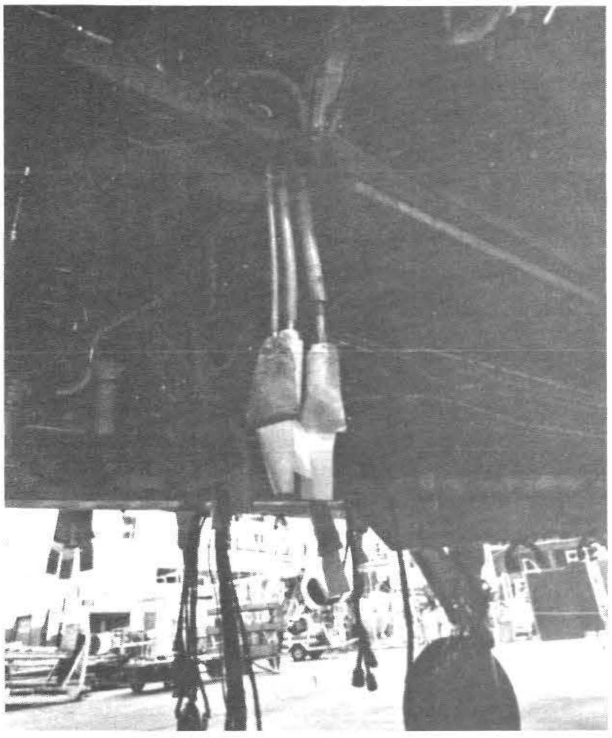

Fig. 3. BEFORE painting deck white.

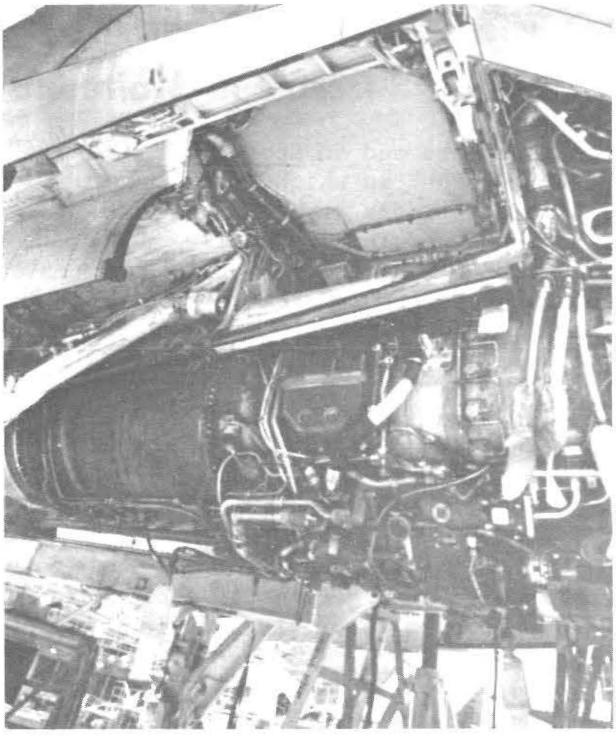

Fig. 4. AFTER painting deck white.

As in the original article, it is emphasized that the lighting level should be, where possible, in the range recommended by lighting standards such as the Illumination Engineering Society Lighting Handbook. Also, in addition to the benefit of reflection of light from the deck onto the underside of aircraft, reflection from walls and ceiling (from non-glossy but highly reflective surfaces) also can contribute significantly to the overall quality and quantity of illumination.

The above photographs and Approach article were viewed with interest by the FAA. After reviewing their experiences, FAA officials indicated concurrence in the principle and related that a few of their installations had a reflective deck, generally a gray paint coating (paint composition not indicated). Only one installation (Anchorage) was believed to be coated with a white (off-white) coating. The coating was an epoxy paint (2 coats) with a fine grain white sand lightly applied to the first coat while it was still wet. Data received from the Anchorage facility indicated that this minimized any tendency to slip when the surface is wet or oily, and that the illumination was greatly enhanced without any additional lighting. Not only were the floors coated but also the ceiling and overhead structures. Figures are available on the increase in illumination levels; a dramatic increase was achieved since the original surfaces were very dark and non-reflective.

More recent developments at commercial aviation facilities include the following:

(1) Miami International Airport: A new hangar being built (National Airlines) will have 200,000 square feet of white (off-white) "porous" concrete deck. A "porous" deck was stipulated to prevent a slippery deck which would occur occasionally in that locality due to unusual weather phenomena.

(2) Dulles International Airport: A new hangar is incorporating diffuse fluorescent lighting panels imbedded in the concrete deck; this is reported to be very expensive, however, due to difficult structural problems.

(3) San Francisco: A Western Airlines hangar had a white (very light gray) concrete deck applied three years ago. It is a hard, smooth, "terrazzo-like" surface (composition not identified). The maintenance foreman states categorically that it has been "terrific" from both the illumination improvement and maintenance standpoint. It cleans up easily and beautifully but oil spills must be cleaned up immediately to prevent slip accidents.

The British Navy expressed interest in the Approach article and sought information relative to a type coating which was both fire resistant and non-skid. A trial was carried out on a British carrier at the end of 1970 to evaluate the use of a white non-slip paint on aircraft hangar decks. The paint adhered well despite heavy traffic and the light reflection was good but to maintain the surface in "satisfactory" condition required "excessive" use of manpower. Information is being sought on the type (composition) of the coating used in this trial.

Currently, the Naval Facilities Engineering Command has programmed a special project at NAS Oceana, Va., in which a reflective coating is to be applied to a hangar deck. Disadvantages of alternate methods are stated in an interim project report prepared by the RDT and liaison officer, LANTDIV, NAVFAC as follows: "Use of portable lighting is normally inconvenient; drop cords are a traffic and safety problem; battery powered lights are hazardous; floor receptacles are expensive and easily contaminated with dirt, water and any spillages; and flush mounted lights would be extremely expensive due to wheel loads."

Proposed for the Oceana project is either a white urethane (Tennant #420) coating or a polyurethane rubber (Crandalon). Service life of either is expected to greatly exceed ordinary traffic paint or enamel types of white paint. The following photos (Figs. 5 and 6) show test areas painted as a preliminary study to the current project:

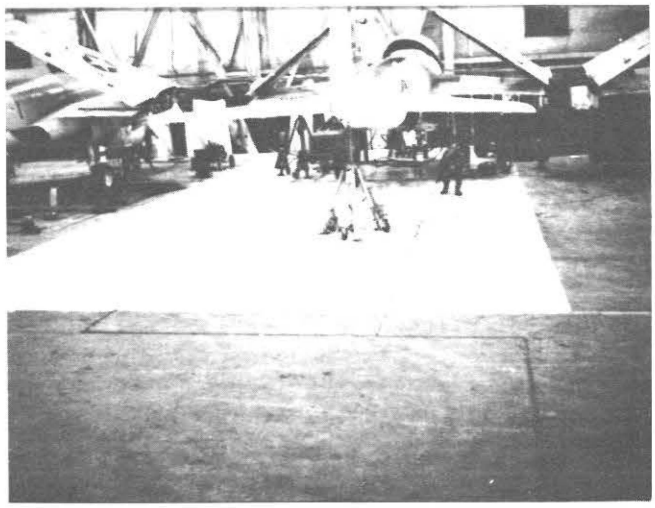

Fig. 5. *Initial condition of applied coatings.* Side "panels" (not distinguishable in this photo) are standard white traffic paint. Center "panel" is the urethane coating.

Fig. 6. *After several months use.* Note durability and greater reflectance of *center urethane panel.*

Note the contrast between the painted area and the dark (permanently soiled) concrete (Figure 5). After several months use, the urethane coating (center panel of Figure 6) showed only slight damage due chiefly to minor cuts by some type of sharp object. Tire tread damage and effects from other possible sources such as spilled oils and fuels contributed to the paint disfigurement seen on the side panels (white traffic paint).

The current project at NAS Oceana is a full scale test involving the coating of the entire deck of a hangar. The results will provide further answers to questions relating to the proper choice of coating and the maintenance costs/efforts required. The reflective light principle has a definite beneficial application in improving illumination and preventing FOD but factors such as compatibility of coatings with surfaces, durability of coatings, cost of application and maintenance and ease of maintenance must be considered in its application.

It is recommended that activities undertaking to improve illumination by this method consult with their NAVFAC engineering office. NAVFACENGCOM has recently made background studies (resulting in the Oceana experiment), has consulted with NAVAIRSYSCOM and others, and has practical experience in the chemistry of coatings and maintenance problems involved.

-John T. Maccioli
Naval Safety Center

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General NATOPS on Beards and Oxygen Masks

OPNAV Instruction 3710.7F, NATOPS General Flight and Operating Instructions Manual (1 July 1971) contains a new provision concerning beards: "For those who use oxygen masks routinely, beards are prohibited. Aircraft personnel who do not wear masks routinely shall not wear a beard which would significantly interfere with safe oxygen and smoke mask functions in emergency use." (Please see also page 18, this issue.)

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SHORE ACTIVITY

Facts About Home Fires

Exactly a century ago this year, the Great Chicago Fire almost totally destroyed the city, an event memorialized annually by National Fire Prevention Week (3-9 October 1971). The following article about home fires, based on source material from the National Fire Protection Association (NFPA), may be useful in your local safety education program on fire prevention.

Fires kill some 12,200 persons in the United States each year. Approximately half of these deaths are attributable to residential fires. More than a half million fires break out each year in American homes. Most of these fires are caused by uncorrected heating equipment faults, careless disposal of smoking materials and defective, misused electrical equipment. Hundreds of unsupervised children die each year when they play with matches or when they are left alone in the house while a parent visits or shops. In fact, about one-third of all the children who die from fires each year are alone or unsupervised when the tragedy occurs.

When and where do residential fires take place?

As would be expected, most lives are lost in house and apartment fires between midnight and 0600 when everyone is asleep. Thirty-seven percent of all home fires start in the living room, 22% in the kitchen, 14% in the basement, 13% in bedrooms and 14% elsewhere (all others). NFPA emphasizes that many of these nighttime fatalities could be avoided if everyone slept with his bedroom door closed. Fire spreads upward. One-thousand-degree temperatures can travel far ahead of the actual flames and stairways and halls can become filled with lung-scorching heat, poisonous fumes and blinding, choking smoke. Sleeping with the bedroom door closed can hold back a fire and increase time for escape. If fire is suspected, feel the inside surface of your bedroom door and check for smoke seepage around the edge. If it is hot, don't open it. Use your emergency exit. If the door feels all right, open it cautiously and be braced to slam it shut if you discover fire.

Everyone should have a well rehearsed, pre-planned evacuation routine in case of fire, with an alternate exit from every bedroom. Your plan should include a prearranged signal, such as a police whistle or compressed gas horn, to arouse and alert the household. Well ahead of any emergency, check windows, which are often the best emergency exit to a garage or porch rooftop or escape ladder, to make sure that they are large and low enough to get through and that screens or storm windows open easily from inside. In some cases you may have to install an escape ladder in a bedroom to provide a safe emergency exit. A ladder kept outdoors or in a detached storage room can be used to get at windows from the outside.

NFPA advises that if you are trapped in a room you should seal up cracks around the door with a sheet, clothing or whatever is handy to hold back killing

heat and smoke. A sheet hung out the window will signal rescuers. Opening a window slightly from the top and bottom lets in some fresh air and lets out bad air. If conditions become too severe, NFPA states, straddle the window ledge, wrapping your legs in a blanket or rug for protection against heat, and hold on as long as you can stand it.

Things to remember in smoke are:

1. Heat and most toxic fire gases rise. Crouch or crawl to avoid the most dangerous atmosphere.
2. Take short breaths through your nose. Avoid gulping large lungfuls of smoke.
3. Cover your face with a cloth--preferably damp--to help filter out smoke. A wool blanket helps protect skin against heat.

NFPA notes that in case of home fire, invalids and infants need special help. Other family members should have specific aid assignments. A person too difficult to carry can be put on a rug or a blanket and pulled to safety. On stairs grasp him under the arms from behind and pull him down backwards as you back down. Babysitters should be familiar with escape routes and should be instructed to get children out of the house immediately if fire is suspected.

Families should have an established meeting place outside where everyone in the household is to go for a "head count." The fire department should be called from a neighbor's home or a street alarm box. Finally, everyone in the household, especially the children, should be impressed beforehand with the need to strictly obey the rule: "Once out, stay out!" No toy or treasure or even the family pet is worth risking a human life in its rescue.

Some 200,000 deaths and injuries occur each year from clothing fires. The very young and the elderly are the chief victims. (Please see "The Dangers of Flammable Clothing," pp. 21-23, BESNL 1-71.) Sturdy, tightly woven fabrics and close-fitting garments ignite and burn less readily than lighter fabrics and clothes with long, full sleeves or full, billowing skirts. Among clothing fire-starters are flames, sparks, open fires and the intense heat of electric coils.

For kitchen safety, NFPA has this advice: For pan fires on top of the stove, turn off the heat. Try smothering the flame by covering the fire with a pan cover. It should completely cover the pan. Watch out for yourself and your clothing. For oven fires, turn off the heat. Try smothering the flame by closing the oven door for a few moments. If this doesn't work, open the oven door a crack and use your fire extinguisher (dry chemical or carbon dioxide type). Open the oven door as little as possible. If fire ignites nearby combustibles or even threatens to ignite them, get everyone out of the house, close the kitchen door to prevent the fire from spreading, then get out yourself and call the fire department. Never risk carrying out a burning pan and never put water on a grease fire--it will splatter and spread the flames. Never try to fight anything but a small fire. Dry chemical or carbon dioxide extinguishers (1 to 5 pound sizes) are especially suitable for kitchen use, NFPA states.

Faulty heating equipment causes many fires. As outside temperatures drop, home fire dangers rise. Furnaces should be checked and cleaned regularly by professionals. Flue pipes and chimneys should be in good condition. Room heaters should be kept clean and positioned so that they will not be bumped or overturned

Home Fire Safety Check List

Every two minutes an American home suffers fire damage. Fire is everyone's concern. Most fires can be prevented by eliminating simple fire hazards. The home fire prevention check list on the next page is reprinted with the permission of the Allstate Insurance Companies Safety Department. Use it in your safety education program. ➡

and will not block an emergency fire exit. House wiring should be adequate for electric heaters, if used, and all such heaters should have adequate clearance from walls and combustibles.

The use of extension cords should be avoided, NFPA warns, but if you must use one, be sure the extension cord matches the same size and type cord supplied with the appliance. Use only UL-listed cord sets. Appliances such as clothes dryers, ranges, larger air-conditioners, etc., need special electrical circuits. Do not use these appliances with extension cords to ordinary electrical circuits. Don't overload an extension cord. Add up the number of watts plugged into the extension. The total should not exceed 700 watts for a "regular" (No. 18 wire) extension cord. This NFPA chart will help you figure the approximate electric load (number of watts). These, however, are average figures. For a more accurate determination of watts used, check your appliance's name plate.

	Watts		Watts
Clock	2	Window Fan	200
Lamp	60-150	Vacuum Cleaner	210
Radio	75	Floor Polisher	335
TV	110-315	Toaster	1130
Food Mixer	110	Broiler	1180
Elec. Blanket	190	Radiant Heater	1270

Households can prevent home fires by following NFPA's practical fire prevention advice. As a final precaution, here's a pre-bedtime fire prevention check to make every night:

1. Check ashtrays for smoldering cigarettes or other combustibles.
2. Check portable heaters. Are they turned off or operating properly and are they located away from combustibles and not blocking exits?
3. Check stoves to be sure burners are off or properly set for the night.
4. Check to see that all bedroom doors are shut.

Should fire break out, injuries can be minimized by a well rehearsed, preplanned emergency routine for the whole family. Leave the house, call the fire department from the street alarm box or a neighbor's phone and don't re-enter the house to save valuables or extinguish the fire.

You may never need your fire emergency plan--we hope you don't--but if you do, a little bit of time and forethought can prevent a lifetime of grief.

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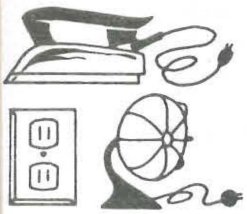
A. CARELESS SMOKING

	YES	NO
1. Are matches and lighters kept out of the reach of small children?		
2. Is smoking in bed (or when drowsing) outlawed in your home?		
3. Is your family aware that ashtrays should never be emptied into waste-baskets?		
4. Are there plenty of large ashtrays in all rooms of your home where smoking may be done?		
5. Are you careful not to smoke near flammable liquids or other dangerous combustibles?		

B. IMPROPER USE OF ELECTRICITY AND APPLIANCES



	YES	NO
1. Do you use only the proper size fuses? (15 amp fuses for lighting circuits)		
2. Are there enough electrical circuits to take care of more appliances?		
3. Are frayed electrical cords or broken plugs replaced immediately?		
4. When purchasing electrical equipment or appliances, do you look for Underwriters' Laboratories stamp of approval		
5. Are you careful not to run extension cords under rugs or hook cords over nails?		

C. ACCUMULATION OF RUBBISH

	YES	NO
1. Are basements, attics, closets, and such out-of-the-way places kept free of rubbish?		
2. Do you dispose of rubbish daily in metal containers outside your home?		
3. Are ashes or embers from any stove or fireplace removed outside and isolated from anything that might catch fire?		
4. Are all oily rags kept in a tightly closed can or burned immediately after use?		
5. Does your family refrain from burning trash or leaves on a windy day or late at night?		

D. FAULTY HEATING AND COOKING EQUIPMENT

	YES	NO
1. Is your heating and cooking equipment, including flues and chimneys, checked at regular intervals by service men?		
2. Is your home free of makeshift heating or cooking devices, other than electrical?		
3. If you have a fireplace, is there a screen always placed in front of it?		
4. Do you check your furnace and chimney to be sure they do not overheat, especially in very cold weather when furnaces work overtime?		
5. Do you call the gas company immediately if you smell gas in your home, at any point other than the burners?		

E. IMPROPER USE AND STORAGE OF FLAMMABLE LIQUIDS

	YES	NO
1. Do you specify non-flammable when buying paint removers, thinners, etc.?		
2. If you do use flammable liquids, do you use them outside, away from flames, sparks, or lighted tobacco?		
3. Do you make it a rule never to use gasoline or benzine as cleaning agents in your home?		
4. If you must have small amounts of flammable liquids around the house, do you keep them in tightly closed metal containers? (never glass!)		
5. Do you strongly prohibit using flammable liquids to start or "freshen" a fire in your home?		

Now that you have scored your knowledge of fire hazards in your home, go back over the list and take immediate action to correct all "no" answers.

Since this check list is offered to you as a guide, you may have other questions which can best be answered by your own fire department.

Camper Deaths from Carbon Monoxide

(The following article is excerpted with permission from the *Occupational Health Newsletter*, Vol. 18, Nos. 11/12, published by the Department of Preventive Medicine, School of Medicine, University of Washington. Two additional cases of dual fatalities in campers are described in the complete paper. One involved a propane heater and the other, a propane lamp. With many Navy men and their families interested in recreational camping, this is a good subject for your fall safety program.)

The tremendous increase in recent years in the utilization of recreational vehicles, particularly during the colder months of the year, has highlighted serious problems associated with the heating and lighting of these vehicles. The ever dangerous potential of carbon monoxide production, resulting from the use of combustion sources in confined and, at times, poorly ventilated areas, again and again raises the specter of death.

The following account is from a news item in the Seattle Times on 12 October 1970, headlined "Heater Exhausts Air - Three Hunters Die in Sleep." According to the surviving companions, the six had left Seattle immediately after work, driving a distance of some 250 miles. They arrived at their destination at 0100 at which time three of the fatigued hunters climbed into the small canopy-type camper expecting to arise early that morning for the opening of deer hunting season.

As the result of an inquiry by the Washington State Health Department, permission was granted to the Health Department to conduct a test of the heater. The Department of Environmental Health was subsequently contacted for assistance and a joint investigation was undertaken. The widow of one of the victims was kind enough to allow use of the camper involved in the fatalities. This vehicle was a 1970 3/4 ton camper especially equipped with an insulated aluminum canopy encompassing approximately 192 cubic feet. The interior was wood panelled. The canopy was sealed between the bottom of the canopy and the edge of the truck bed with a resin and rubber compound. The camper was fitted with a door at the rear, four sliding windows -- two in front and one on each side -- and a gravity air vent mounted in the ceiling. The small propane heater, purported to be in excess of two years old, was of the flameless radiant type. A small hinged panel door at the rear provided access to the fuel cylinder. A warning sign to the effect that the heater should be used only in well ventilated areas was prominently displayed on the interior of the unit.

On 21 October 1970, operation of the heater was examined in Seattle under the following atmospheric conditions: Temperature 47°F; wind, 20 mph with gusts to 30 mph; raining; barometric pressure 29.49 and steady. Weather conditions at the site at the time of the fatalities were: Temperature, low 40s; wind, calm; sky, overcast. Elevation of the Seattle test site was 100 feet above sea level. The scene of the accident was 2000 feet above sea level. A sampling probe was set up on the floor of the camper and directed to a portable laboratory for analysis. Carbon monoxide and carbon dioxide were recorded continuously, utilizing two separate infrared analyzers. Periodic oxygen measurements were obtained from a portable oxygen detector. At the start of the tests the camper was completely ventilated and baseline readings obtained. The heater was then supplied with a new propane cylinder which was ignited and then allowed to operate for 15 minutes after which the heating device was placed in the rear of the camper. Windows, door and vent were all closed, simulating conditions the morning the hunters succumbed. Carbon monoxide levels (Table 1) rose rapidly from 650 ppm after 15 minutes to 1600 ppm after 105 minutes of operation. Carbon dioxide levels ranged from 400 ppm at the start of the test to 9000 ppm after 105 minutes of operation, while oxygen was lowered to 19% at the 105 minute mark.

TABLE 1. Contaminant Levels in Camper With Windows, Door and Vent Closed

Elapsed Time Min.	Carbon Monoxide ppm	Carbon Dioxide ppm	Oxygen %
0	0	400	20.8
15	650	1000	
30	900	2500	
45	1100	5000	
60	1300	6500	
75	1400	8000	
90	1500	8500	
105	1600	9000	19.0

A second test was conducted with two side windows opened approximately 2 inches each. These results (Table 2) indicate that carbon monoxide reached a level of 160 ppm after 45 minutes of heater operation. With only one side window opened 2 inches (Table 3), carbon monoxide reached 190 ppm after 30 minutes of operation.

TABLE 2. Contaminant Levels in Camper With Two Side Windows Opened 2" Each

Elapsed Time Min.	Carbon Monoxide ppm	Carbon Dioxide ppm	Oxygen %
0	0	400	20.8
15	75	800	
30	120	1500	
45	160	2000	20.8

TABLE 3. Contaminant Levels in Camper With One Side Window Opened 2"

Elapsed Time Min.	Carbon Monoxide ppm	Carbon Dioxide ppm	Oxygen %
0	0	400	20.8
15	100	2000	
30	190	3000	20.8

Conclusion: The use of any combustion source in a confined area is fraught with danger. Despite the fact that lamps and heaters may be tested and "approved" because of the low levels or absence of carbon monoxide produced in the test, we must consider the consequence of malfunction. Another problem area deals with interpretation of the warning: Use Only With Adequate Ventilation. "Adequate ventilation" is a difficult term to define even for an "expert" and the smaller the volume, the more difficult the problem becomes. In a cramped bunk area or in a small canopy unit, there could very well under certain circumstances be no such thing as "adequate ventilation." Greater public awareness and more descriptive warnings are needed if these fatalities are to cease.

-Peter A. Breysse

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Disinfecting or Deodorizing???

Recently an activity ordered liquid pine oil disinfectant under FSN 6840-584-3129. This material was to be used by janitorial personnel in scrub water, more as a deodorizer than as an actual disinfectant. The material received was a packet labeled Disinfectant, Germicidal and Fungicidal Concentrate (Phenolic Dry Type), FSN 6840-753-4797. Additionally, the following appears on each packet:

> **CAUTION:** Phenol. Rapidly absorbed through skin. Causes severe burns. Do not get in eyes or skin or on clothing. Avoid breathing dust or vapor. Do not take internally. In case of contact, immediately remove all contaminated clothing, including shoes, and flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get medical attention *after* flushing. **POISON.**

Obviously, this substitute compound is truly a strong disinfectant and must be handled with proper precautions to protect the user. The substitution of such a phenolic disinfectant for pine oil has obvious safety and health implications.

Investigation revealed that the pine oil disinfectant was being phased out and that a substitute material, FSN 6840-530-7109, should have been sent. The substitute liquid material may be any one of several different disinfectants but must carry the following notation of hazards:

> **WARNING:** Harmful if swallowed. Do not get in eyes or on skin. In case of contact with skin, wash thoroughly with soap and water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention. **ANTIDOTE:** (Supplier shall furnish antidote for specific disinfectant.)

While possibly not as hazardous to use as the erroneously substituted phenolic disinfectant, this material should also be used with due caution. (In the usage here, "disinfectant" is a chemical agent which destroys pathogenic or disease-producing organisms. Both FSN 6840-584-4797 and FSN 6840-530-7109 are for disinfecting latrine buckets, urinals, toilet bowls, garbage cans, etc. FSN 6840-530-7109 is also used for cold disinfection of surgical instruments, gloves, etc.)

In the case of the substituted phenolic disinfectant there was no ultimate injury or accident because of timely and proper action by supply and safety personnel. The incident may serve to alert readers to potential future problems. It is suspected that many commands and activities utilize the pine oil disinfectant because of its pleasant odor. That is, it is used not as a disinfectant in the true sense but rather as a deodorizer. If this is, indeed, the case, then the phaseout of pine oil and the substitution of other disinfectants may result in injuries unless proper training and precautions are given to personnel involved in the mixing and use of the materials.

It is recommended that all activities review their use of pine oil disinfectant and make sure that they really need a disinfectant and not just a deodorizer. If only a deodorizer is needed, the use of pine oil to eliminate odors could be supplanted by better cleaning procedures or ventilation.

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Moving Machinery Is an Unforgiving Foe

When you work at one machine for a long period of time you can unconsciously lose your respect for its dangers. Rotation of personnel may not be possible in such circumstances but continual emphasis on the dangers of moving machinery is.

For eight months a young Seabee had had the job of fabricating standard concrete blocks of a certain size on a concrete block machine. One morning not long ago he was watching the machine while it ran automatically. He thought he saw a primary nut loose on the machine and without thinking stuck his right hand in the machine while it was operating to see if the nut really was loose. The machine continued to function and he was unable to withdraw his hand in time to avoid injury. When the heads which compress the concrete in the molds came down to strip a completed block from the molds, his hand was caught between the heads and a stationary part of the machine. He sustained severe hand injuries.

Investigators cited the following contributing factors:

. The Seabee was too familiar with the machine and became careless.

. The machine can be run either automatically or manually.

. Safety guards cannot be installed in this area of the machine because it is a primary moving part.

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Passenger on Forklift Injured at Shipyard

Nobody is supposed to be on a forklift but the operator and everybody in the "world of yellow equipment" knows this but every so often somebody disregards safety precautions and gets hurt.

At a naval shipyard recently at the request of the forklift operator a helper rigger climbed onto a forklift for a refueling trip from the north end of the floor of a drydock to the refueling box at the south end. On the approach to the refueling box the operator executed a left turn at which time the right rear wheel of the forklift ran through a drydock drainage ditch causing the passenger to slip off. The right rear wheel of the forklift ran over his left foot and ankle and pinned him under the vehicle. He sustained multiple fractures.

Both the operator and the injured man were in direct violation of existing safety regulations regarding passenger restrictions on forklift type vehicles, investigators said. The forklift operator has received an official reprimand for failure to observe safety regulations and the injured man has been verbally cautioned with regard to strict adherence to all safety regulations in the future. Continued safety education in all areas where moving equipment is used is in order.

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SUBMARINE/ DIVING

The Life Change Unit as a Stress Indicator Among Submariners

Perhaps one of the most difficult tasks confronting a submarine medical officer on either the ship or squadron level is the accurate assessment of the various liabilities posed by the physical illnesses and emotional problems of his patients. A man whose mental or physical state deteriorates at sea may jeopardize the mission by necessitating a medical evacuation, jeopardize the boat by acting in an unsafe manner or may, himself, be in jeopardy of not being able to receive indicated medical care. In dealing with a case of a classical illness with a somewhat predictable course, the submarine medical officer in his function as soothsayer has some credibility. In predicting the repercussions of mental states arising from routine day-to-day stresses, the medical officer must often resort to guesswork. Since the rigors of submarine life and consequent domestic problems are routine stresses common to most submariners, the physician faces a great challenge in evaluating what may be subtle changes in his patient, changes which may nevertheless lead to disease or, as we believe, unsafe behavior.

The notion that the emotionally stressed individual may be more likely to contract illness or be prone to accident is not new. It has long been known, for instance, that overly stressed individuals often engage in irrelevant activities or rigid stereotyped behavior and experience loss of discriminative skill and mental efficiency. Safe performance of complex tasks is improbable in such a psychologic context.

The relationship between routine stress and process of disease in man was postulated many years ago by Adolf Meyer[1] and more recently by Harold Wolff.[2] The practical use of the stress theory of accident and illness causation has, however, been quite limited. Factors which produced stress, it was often felt, as well as the repercussions of stress varied considerably from individual to individual. This variation made it virtually impossible to quantify stress and to measure its effects in a statistically valid manner. Without such study, accident and illness prediction on the basis of stress was not feasible. Within the past 10 years, however, at the University of Washington and the U.S. Navy Neuropsychiatric Research Unit in San Diego, a new way of looking at stress has been developed. It was first statistically determined that certain ordinary routine life events when they occurred in clusters called life crises had pathophysiological significance in leading to disease. These life events consisted of occurrences involving the individual or influencing his life style. They tended to center around social and interpersonal transactions involving family constellation, marriage, economy, occupation, residence, education, recreation, health and peer relationships. Many

of these events were socially desirable in a conventional sense and in accord with American values. The constant factor among these events was change in and of itself. Life change of any kind, it was felt, evokes coping behavior on the part of the involved individual which is inherently stressful. Thus, all that need be involved is change from the existing steady state of adjustment, regardless of psychologic meaning, emotional impact or social desirability.

When asked to examine a list of specified life changes and to rank them according to perceived severity, individuals within a population of 394 subjects studied at the University of Washington showed a high degree of consensus concerning relative order of magnitude and importance.[3] Furthermore, discrete groups within the sample segregated by sex, age, generation, education and religion also showed high degrees of correlation in their responses. As a result, of this study, the hierarchy of life events shown below was devised consisting of 42 experiences, each with a derived mean value. The numbers which indicate the relative importance of each event were designated as life change units (LCU). Further studies have since indicated a high degree of consensus in the relative importance of life changes not only among American ethnic groups but among peoples of various nations.[4]

Life Event	*Mean Value*
1. Death of spouse	100
2. Divorce	73
3. Marital separation	65
4. Jail term	63
5. Death of close family member	63
6. Personal injury or illness	53
7. Marriage	50
8. Fired at work	47
9. Marital reconciliation	45
10. Retirement	45
11. Change in health of family member	44
12. Pregnancy	40
13. Sexual difficulties	39
14. Gain of new family member	39
15. Business readjustment	39
16. Change in financial state	38
17. Death of close friend	37
18. Change to different line of work	36
19. Change in number of arguments with spouse	35
20. Mortgage over $10,000	31
21. Foreclosure of mortgage or loan	30
22. Change in responsibilities at work	29
23. Son or daughter leaving home	29
24. Trouble with in-laws	29
25. Outstanding personal achievement	28
26. Wife begins or stops work	26
27. Begin or end school	26
28. Change in living conditions	25
29. Revision of personal habits	24
30. Trouble with boss	23
31. Change in work hours or conditions	20
32. Change in residence	20
33. Change in schools	20
34. Change in recreation	19
35. Change in church activities	19
36. Change in social activities	18
37. Mortgage or loan less than $10,000	17
38. Change in sleeping habits	16
39. Change in number of family get-togethers	15
40. Change in eating habits	13
41. Vacation	13
42. Minor violations of the law	11

Whereas the relationship between a life change cluster period or life crisis and the onset of illness was previously only a concept, it was now possible to quantify the parameters involved. In a study of 88 persons in Seattle,[3] it was found that 93% of health changes which occurred during the study period were associated with a clustering of life changes whose values summed up to at least 150 LCU and ranged as high as 500 LCU per year. The number of life changes involved in a cluster ranged between seven and 25. The duration of the crisis was found to be generally one to two years. It was also shown that the magnitude of the LCU score and the risk of associated health change were directly related. For subjects with scores between 150 and 199 LCU, 37% had associated health change. Those between 200 and 299 LCU had 51% and those over 300 LCU per year had 79% incidence of health

change. Although the relationship between life change and unsafe behavior was not specifically studied, accidents associated with body trauma did seem to appear during a life crisis period. If stress does indeed contribute to human accident liability, this finding is not totally unexpected.

The consideration of life change is quite germane to discussion of the submariner population. This group undergoes a wide spectrum of repeated alterations in living style requiring high levels of adaptation. Based on the three month SSBN deployment schedule, I have compounded a one year total of LCU's common to most married members of the crew.

	LCU	
1. Change in responsibility at work	29	
2. Change in living conditions	25	
3. Revision of personal habits	24	
4. Change in working hours or conditions	20	
5. Marital separation	65	
6. Change in residence	20	
7. Change in recreation	19	
8. Change in social activies	18	
9. Change in sleeping habits	16	
	236 per deployment	472 LCU per year

Living as he does with high degrees of routine occupational life change stresses, the submariner's reaction to further domestic, financial and personal changes should become a matter worthy of attention. Even the most adaptive of persons may be expected to reach a point at which resistance to the effects of stress deteriorates. In persons with critical jobs, such a point may be worth watching for from a health, operational and safety point of view.

A grasp of the concept of the stressful life change can, I believe, be of great use to the submarine medical officer. He will find that because many life changes are relatively uncomplicated by heavy emotional impact and stigmata, a pertinent history of a life crisis can be obtained with little effort. For the same reasons, total crew screening using a life change questionnaire should be quite successful. The application of past research in the area of life changes to a submarine population is, at present, uncertain. The life crisis, for instance, may need redefinition in a population which routinely undergoes significant repeated occupational life changes. I believe, however, that the life change unit, itself, is a useful tool. Although its ultimate application to submariners has not yet been precisely defined, the life change unit allows some objectivity in what has heretofore been a vague subjective area. I suggest that the submarine medical officer keep himself aware of the changes taking place in the lives of his boat's crew, keeping in mind their stressful nature. In such a way he may be able to predict to some extent accident behavior and proclivity toward the development of disease, an ability which would enhance the safety and operational capabilities of his boat.

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Short-Sightedness Can Lead to No Sight at All

A petty officer on an SSBN recently sustained eye injuries while loading monoethanolamine from barrels located topside using an air driven positive displacement transfer pump. He temporarily secured loading and shut the onboard fill connection isolation valve in order to clear blockage from the pump section. He failed to reopen the isolation valve prior to recommencing transfer. This resulted in failure of the pump discharge fitting because of overpressurization and subsequent spray of monoethanolamine onto his face and eyes. He was not using a protective faceshield or goggles at the time of the accident. Investigators found that no pump discharge relief for a safe discharge path had been provided.

The man received first aid from personnel on the scene and was taken to the nearest hospital. In spite of treatment with atropine, local antibiotics and local and systemic steroids, his right eye became worse over the next six weeks. He was subsequently transferred to the Naval Hospital at Bethesda with progressive inflammation of the cornea, cataracts and imminent corneal perforation.

Monoethanolamine (MEA) is a dangerous, corrosive, toxic material in both liquid, mist and vaporous states. It is capable of producing severe eye damage, skin irritation, respiratory tract irritation and damage to internal organs. The emergency treatment for eye or skin contact with MEA is immediate and thorough irrigation with water for at least 15 minutes. The danger of MEA is sufficient to warrant use of a protective full faceshield or, at the very least, eye goggles whenever splashing of these materials is possible. Protective clothing should also be worn and if contaminated should be laundered before reuse. Either eye contact or skin burns require immediate medical attention.

The recommended maximal atmospheric concentration (8 hours) is currently three parts per million. Fortunately, the chemical's fishy-ammoniacal odor is normally detectable at 2-3 ppm, making inadvertent exposure unlikely. Should exposure occur, the most probable effect would be respiratory tract irritation. Repeated excessive inhalation may lead to liver and kidney damage. If the vapor of monoethanolamine cannot be maintained below the odor level, respiratory protective equipment should be worn. This writer feels that, out-of-doors, a chemical cartridge respirator with a special cartridge designed for amine should provide adequate protection. Atmospheric contamination below decks dictates the use of an air line respirator such as an EAB (emergency air breathing mask). A listing of appropriate respirators, cartridges, faceshields, eye goggles and protective clothing can be found in the Safety Equipment Manual, NAVMAT P-10470.

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